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Electrical Refrigeration.

MOST applications of electricity tend to expand naturally—electric lighting because it has no rival in the direction of artificial illumination, electric ironing because of its ease and safety, electric driving on account of its flexibility and absence of trouble to the user, and electric cooking and heating because of their cleanliness and "controllability." Convenience is, of course, a factor common to all these and other applications. On this account a general electrical campaign is all that is necessary to speed up the rate of progress in all the departments mentioned.

But, apart from these, there are certain uses of electricity which are of a more special nature—we shall not say less essential—and to stimulate interest in these, specialised efforts are necessary.

Hence the Electrical Refrigeration Campaign which, organised by the British Electrical Development Association, is to be conducted from next Friday (June 8th) until June 25th. This campaign is to be carried out on similar lines to the two larger campaigns which E.D.A. has to its credit. That is to say, initial interest will be aroused (and useful free publicity obtained at the same time) by means of a luncheon at which electrical men and representatives of the Press (particularly the daily newspapers) will meet. This method has been proved to be a very effective one to give the campaigns a good start. The Association is offering free advertisement blocks for use in local papers, and has produced a variety of publicity matter for the use of supply undertakings, contractors and dealers.

Apart from the efforts of individual firms, there has not yet been a determined refrigeration "drive," although the potentialities are enormous. Granted that the cost of the apparatus is too high for a very large proportion of electricity consumers, there are yet many thousands of homes in which a refrigerator could be installed with advantage at a price well within the capabilities of the owners. And here the hire-purchase system has been adopted and may be worth extending.

This is quite apart from the immense field offered by numerous classes of commercial undertakings and institutions. In any hotel, restaurant, food store, or even small shop a refrigerator should be considered indispensable, and the same may be said of such institutions as hospitals, where the purity and cleanliness of the food is of the first importance. The regulations restricting the use of preservatives in foodstuffs which have been put

into force during the last two years are a factor tending to the greater use of electrical refrigeration.

It does not appear to be generally appreciated how wide the scope is in this country; the Americans, however, are closely watching the British market, as will be seen from the article printed on the next page. We were the second largest importer of American refrigerating equipment, up to 1-ton capacity, in 1927, while another part of the Empire, Australia, headed the list. A Swedish concern also thought well of the potentialities in this country when it started a refrigerator factory here.

Surely, then, the business is worth while, and we hope that all concerned will recognise this and pull together in the Electrical Refrigeration Campaign.

Electricity in Mines.

THE unfortunate accident at Temple Pit, Templenewsam, Yorkshire, on April 13th last, when three men were trapped and killed, is still the subject of inquiry, and a final view as to its cause cannot properly be expressed until the report is issued.

From the evidence of Professor R. V. Wheeler, of the University of Sheffield, as reported in our last issue (p. 915), it appears that the switch controlling the electric fan was not of a flameproof pattern, and he (very properly) considered that it should have been. The following dialogue took place between Professor Wheeler and Mr. Herbert Smith, president of the Miners' Federation:—

Mr. SMITH: It amounts to this, that electrical machinery is unsafe in coal mines.

Prof. WHEELER: I don't think so at all. I think it can be made perfectly safe.

Mr. SMITH: It will take a big explosion, killing many people, to convince you otherwise.

Now, making every possible allowance for Mr. Smith's anxiety for the safety of the men, which is, we venture to say, shared by everyone, it is sheer nonsense to say that electrical machinery and apparatus is unsafe in coal mines. That it *can* be unsafe, when the wrong sort of apparatus is used, or when the right sort is improperly installed, no one will deny; but when properly-designed and constructed apparatus is installed as it is intended to be used, the electrical method is the safest of all, and in some cases it is the only safe method. The first requisite in apparatus for use in mines is robustness, the second is robustness, and so is the third. The design of flameproof switchgear, boxes, fuses, motors, transformers, and what not, is well understood, but it must also be appreciated that conditions underground make it inevitable that the apparatus will be roughly handled; and it must be capable of withstanding rough handling. This makes mining-type gear expensive, as compared with similar gear for ordinary industrial situations, but it is the worst kind of false economy to buy cheap apparatus; and the reputation of the electrical industry requires that only that which has been proved adequate should be offered for use in such dangerous situations.

Missing Words.

IN our "Correspondence" columns to-day, Mr. R. O. Kapp raises a question of considerable interest—the need of a name for that paradoxical unit of power which is, to borrow a useful term from telephone practice, a "phantom," and yet is of great and growing importance. In the early days, when names were being allotted to the electrical units, "power factor" was of little import, and the term had not even been invented; consequently no provision was made for the convenient identification of the wattless component of power in an a.c. circuit, or its derivative, the "workless energy," and so far as we know, in no language have these deficiencies been remedied. Here is a chance for inventive genius!

The most important unit of all—the kilowatt-hour, commonly known as the "Board of Trade unit," which is not a name but a description—is equally in want of a short title. Efforts have been made to christen it the "kelvin," and the adoption of that great name in accordance with the system of commemoration by which electrical nomenclature generally is characterised, seems appropriate; but unfortunately it has never come into popular use—and this is one of the three electrical units with which the layman must be more or less familiar. It is so closely associated with the quantities for which Mr. Kapp invites suggestions that, perhaps, a family word might be devised, with inflections or affixes distinguishing between the respective quantities. We commend the search for suitable terms to the attention of our readers.

Payment by Results.

THE decision of the Amalgamated Engineering Union to recognise the principle of payment by results, recorded elsewhere in this issue, is somewhat belated, if it is true, as was said, that 75 per cent. of the Union's members are already working under some system of this kind. This estimate is probably on the generous side, for before the Balfour Committee it was stated by the Engineering & Allied Employers' Federation that, in 1927, 19 per cent. of its members' employés were paid by results.

There was no doubt good reason for the trade unions' suspicion of payment-by-results systems in the past; many employers objected to their hands earning a great deal more than they did when paid by time, and piece-rates were accordingly cut. We have travelled a long way since then, however, and such a body as the A.E.U. with the support of fair-minded public opinion, should be able to combat any attempt to abuse the system. Moreover, the employers have repeatedly expressed their recognition of the fact that engineering workers are comparatively ill-paid and they will be only too glad to bring about contentment if, although higher wages are paid, their unit costs are reduced.

There is to be an effort to bring about a national agreement to govern the system, and we believe that the engineering employers will be willing to negotiate now that the Union's recognition of payment by results has been secured.

Electricity Charges Inquiry.

THE charges for electricity levied by the County of London Electric Supply Co., Ltd., on its domestic and trade consumers have long been the subject of adverse criticism—to use a very mild expression—and the inquiry which was held by order of the Minister of Transport last week was fully due. As we have previously pointed out, the Company, on which a monopoly was conferred by Parliament for the conduct of an indispensable public service, has exercised its privileges mainly in the interests of its shareholders, charging comparatively high prices, piling up immense reserves, and distributing heavy dividends year after year, in marked contrast with the praiseworthy practice of the municipal undertakings which serve similar areas in London at very low prices. Such wide disparities are bound to arouse ill-will, to retard electrical development, and to exercise an adverse influence on the electrical industries in general.

The inquiry, which was adjourned pending consultation between the Company and the complainants, was not without amusing features. Counsel for the Company was artless enough—or should we say had the hardihood—to claim that as the Company had invested a large part of its profits in its own undertaking, it was a mistake to assert that all the reserves came out of the pockets of consumers. This was too much for the chairman, who naturally wanted to know where the money came from. Where can such profits come from, if not from the pockets of consumers? It is interesting to learn that at last the Company is preparing a two-part tariff, which will be ready for work *by the end of the year*! Why not next quarter-day?

The World Refrigerator Market.

An American View of Possibilities in the United Kingdom.

AN able report upon the above subject by Mr. C. H. Ducote, of the Electrical Equipment Division of the United States Bureau of Foreign and Domestic Commerce, appeared in a recent issue of *Commerce Reports*.

The author shows in the first place how rapidly exports of refrigerators from the United States have grown, and how they have been distributed. He mentions, incidentally, that the sales of domestic electric refrigerator units in the United States increased from 248,000, valued at $65,200,000, in 1926, to 365,000, valued at $82,125,000, in 1927. In the 1926 export statistics electric refrigerators were placed under the general heading of "refrigerators" and the total value was given as $1,443,732. In 1927 exported refrigeration sets up to one ton capacity alone had a total value of $3,684,981. An analysis of these exports shows that Australia was the principal customer, taking goods to the value of $587,437. The United Kingdom ($419,368) was second on the list, and Canada, Brazil, Argentina, British South Africa, and British India followed. Those parts of the British Empire specifically mentioned accounted for $1,653,463 of the total, or nearly 45 per cent.

By far the largest market for small refrigeration equipment exists in countries in the North Temperate Zone. In 1927 45 per cent. of the American exports went to this group, of which the United Kingdom took the largest share. The use of ice in Europe is not known to the same extent as in the United States. In the United Kingdom, however, the use is increasing, and there is a well-sustained market for electric refrigerators for household use and in retail stores for the preservation of foodstuffs. In spite of the difficulties of high initial cost and climatic and other factors, the possible ultimate development in this field is worthy of the attention of manufacturers. Most of the competition in the United Kingdom is among British and American concerns already established.

The Canadian demand for electrical refrigeration equipment for use in hotels, stores, and homes is increasing. The standard of living is similar to that of the United States, and there is an extensive use of ice and refrigeration.

The use of refrigerators in Germany is increasing slowly, and with improvement in economic conditions in general, an important market should be developed for such equipment.

A large part of Italy lies in a region where fairly warm weather during the summer months makes necessary the use of artificial ice as a means of obtaining refrigeration. In some centres, as in Naples, the retail price of ice is high, which increases the use of electrical refrigeration in shops and homes.

The Danish refrigerating and ice-making industry is large and steadily growing. It not only supplies the domestic market, but also has an important export trade. The demand for refrigerating equipment is limited, owing to the nature of the climate, but the introduction of small electrically-operated units has met with considerable response, and a further demand may be anticipated. Climatic conditions in Norway and Sweden do not favour the use of ice, but in spite of this, the use of ice is growing, and as the standard of living advances, a fair volume of electrical refrigerating equipment will be in demand.

The market for this class of equipment in North China is very limited owing to the restricted purchasing ability of the general public combined with the high cost of apparatus. Farther south, especially in the Shanghai region, many hotels, restaurants, clubs, shops, &c., have been equipped with electric refrigerating plant within the past few years. The demand comes almost entirely from foreigners.

United States exports of refrigerating sets up to 1-ton capacity to countries in the South Temperate Zone in 1927 were valued at $911,209. Although the use of ice in Australia has not developed to so great an extent as in America, it is greater than in England. A good market has existed for some time, and the products of American manufacturers have met with particular favour. Only a small proportion of the people of New Zealand have refrigerators in their homes, and apparatus is not used extensively by hotels. Recently, however, dealers have successfully placed equipment in representative homes, and there is every indication that the demand will increase.

The use of ice in Argentina is confined to the better-class homes, and the demand is not extensive. Within the past two years a number of artificial refrigerating systems, mostly of American manufacture, have been placed on the market, and it is noted that they are gradually gaining in popularity. The field for small electric refrigerating equipment is promising when the hotels, meat markets, shops, restaurants, &c., become interested in this kind of equipment.

The Semi-Tropical Zone took small American refrigerating equipment valued at $426,901 in 1927; South Africa's share was 40 per cent., and Mexico's 18 per cent. The South African market for this equipment is limited, but fairly constant, and is supplied mainly by Great Britain, with important amounts from the United States and Germany. The general standard of living in Mexico is not conducive to the widespread use of refrigerating equipment; practically the only users of ice in the larger cities are restaurants, hotels and saloons, and they are often conducted on too narrow a margin of profit to permit the installation of costly equipment. So far as climate is concerned, the sea coast cities appear to offer the best market. The sales possibilities in several other countries in this zone, although small as yet, are increasing. Among them are the Dominican Republic, Guatemala, Cuba, and the Haitian Republic. In the last country an impetus has been given by the electricity supply company at Port au Prince in the way of special rates for power used for this purpose. The high price demanded for ice will tend to increase the sales of refrigerators.

In tropical countries the natives have adapted themselves to the conditions, but a supply of ice is a necessity to the foreign population. The American exports of small refrigerating equipment to these countries in 1927 were valued at $664,463. The homes of the wealthy in Brazil and to some extent those of the middle classes make use of ice and ice-boxes, and hotels, hospitals, and breweries obtain ice for the preservation of perishable foodstuffs. Potentially the market for refrigeration is large on account of the heat, and sales are constantly on the increase. The high prices which have to be charged for equipment militate against its sale; most of the apparatus sold has consisted of household units of American manufacture. In Ecuador and Colombia the demand for ice and ice-boxes is expected to grow; in the coastal cities the electricity supply is dependable.

Notwithstanding India's hot climate, relatively little ice is used there. Refrigeration is, however, making some advances in most parts of India, and though progress has not been rapid, the future may be viewed with optimism. The demand for ice in Burma is growing, and a market could undoubtedly be created for ice-making plant of small capacity.

A Large Switchgear Works.

Some impressions of a visit to the factory of Messrs. Ferguson, Pailin, Ltd., at Higher Openshaw, Manchester.

THE progress made by the firm of Messrs. Ferguson, Pailin, Ltd., may perhaps justify its inclusion in the list of industrial romances which we are becoming accustomed to hear about in some quarters. Established in 1913 as a partnership, under the style of Ferguson, Pailin & Co., the firm started operations in a small factory in Edward Street, Manchester, within a stone's throw of the present works, which had a total floor space of 189 sq. yd., with only a couple of employés. To-day the total floor space of the main factory and offices amounts to something like 30,000 sq. yd., and there are more than 1,000 employés at the Openshaw works alone. Almost from the beginning of the firm's existence extensions to the works were continually being effected, at first to the Edward Street factory, and later to the Buckley Street works, which were first established in 1920. In 1924 it was decided to erect very considerable extensions which would cover the requirements for a long period; these extensions were completed during last year. Some idea of their size, as compared with the works as they were in 1924, may be gathered from the aerial view shown in fig. 1; the bays at the rear of the picture, running in line with the eye, represent the extension in question, while the bays in the foreground, behind the office block, are roughly the works as described in our issue of June 29th, 1923, p. 1019.

Fig. 1.—Aerial View of "F. P." Buckley Street Works.

The works, which were erected entirely by the firm itself, are laid out along the usual modern mass-production lines, so as to afford the highest working efficiency of the whole or any part or department. On walking through the works one is particularly struck with the smooth working between the departments; each is at once a "works" on its own, but essentially a part of the whole. The necessary co-ordination is arranged without overlapping or confusion; but it is only fair to mention that the spreading-out which is permitted within the factory emphasises this feature. The motive power throughout the works is provided by means of electricity, and motors of some 560 h.p. are installed. The supply is received from the Manchester Corporation mains at 6,600 V.

In addition to the usual machine, fitters', smiths' and other shops which go to make up a large switchgear works, or indeed any engineering works of appreciable size, there are a number of sections peculiar to the class of work dealt with, and various special machines, some of which are of Messrs. Ferguson, Pailin's own design. A department of unusual interest is that devoted to the assembly of the large bakelite bushings used in the firm's heavy products. A corner of this department is shown in fig. 2. The large machine is a 50-ton hydraulic press engaged in inserting a large bakelite bushing in its spout. No cement whatever is used in this operation, and a shrinkage fit is obtained between the two elements. The metal spouts are, of course, heated before insertion in the press. It is, perhaps, a foregone conclusion that the various F. P. bakelite-composition products are moulded on the job. On the left of fig. 4 is shown a number of bakelite moulding presses. The same illustration portrays a portion of the impregnating plant with which the works are equipped. Metal pressing is done extensively in the factory, and in the approperiate section there are power presses installed ranging from 10 to 100 tons capacity. On the largest machines metal sheets of up to 4 ft. width can be worked. Compound filling is, of course, an important operation in connection with heavy-type metal-clad switchgear, and suitable arrangements are made to provide efficient filling. Fig. 6 shows a large heating oven used in connection with the filling of the heavy compound-filled chambers. These are put into the oven, preheated to a given temperature, and then filled. Special arrangements have been adopted to provide for filling the chambers from the bottom, so as to avoid all possibility of air pockets, and the apparatus used is depicted in the illustration in question. As a contrast to the usual somewhat commonplace sheet-metal department of an engineering works, the one at Higher Openshaw is worthy of special note by reason of the work involved in the making of large oil-switch tanks. A section of the department is shown in fig. 7, and in the foreground is a special hydraulic machine which has been designed and constructed by Messrs. Ferguson, Pailin, for the purpose indicated. This machine is capable of quickly making the four bends for the tank sides in thick boiler-plate. The machine on the right of the picture is another of the many items which attract the eye of the visitor, but are commonplace to those on the job. It is a specially designed copper-bending machine capable of bending 4 in. × ¼ in. copper bar on edge through 90 deg. Two other machines designed also by the firm in question for similar special work are shown in fig. 9, which illustrates a section of the slate-panel switchboard erection department. The machine on the left is capable of twisting, *en bloc*, through 90 deg., eight pieces of 6 in. × ¼ in. copper in a length of 4½ in., without fracture. The machine on the other side is a portable hydraulic press which will bend copper bus-bars, connections, and so on, through any angle. It is possible on this machine to make a double right angle or joggle as close as 2 in. from bend to bend.

Another specially designed machine for the class of work peculiar to the factory is depicted in fig. 8. This is a large horizontal grinding machine with a travelling head, having a 4.5-ft. segmental disk and an 8-ft. travel. It is driven by a 50-h.p. motor and is capable of grinding very large broken surfaces.

In order to cut down to a minimum the transit of goods inside the factory, each department has its own

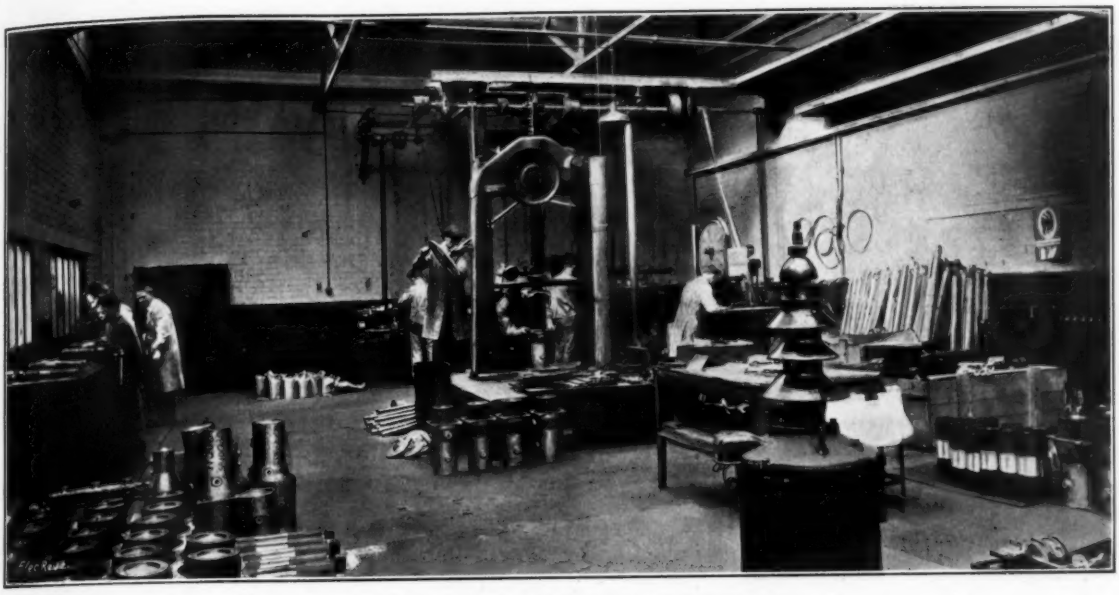


Fig. 2.—Corner of Bakelite Bushing Department.

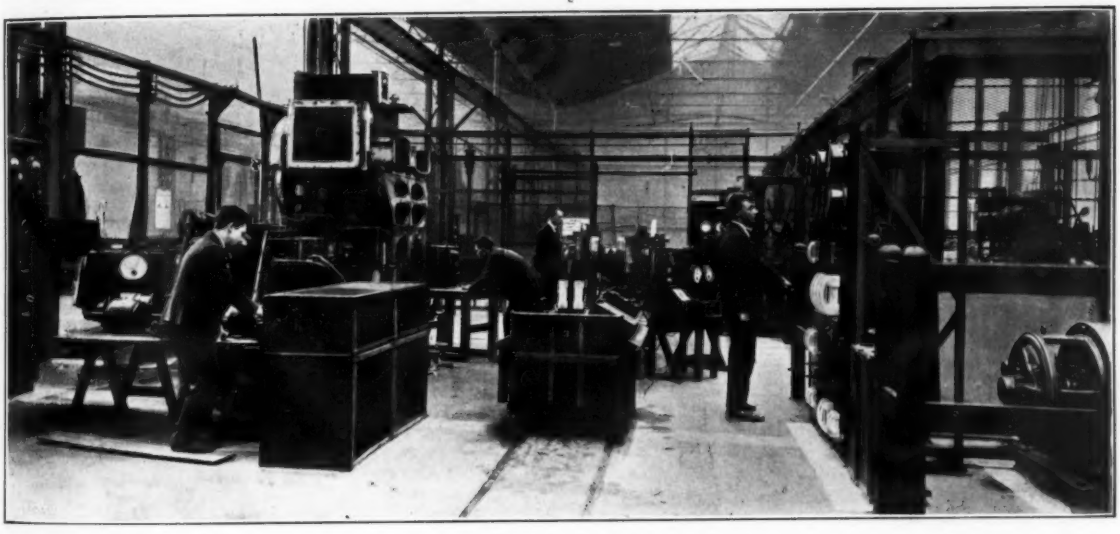


Fig. 3.—Special and Routine Testing Room.

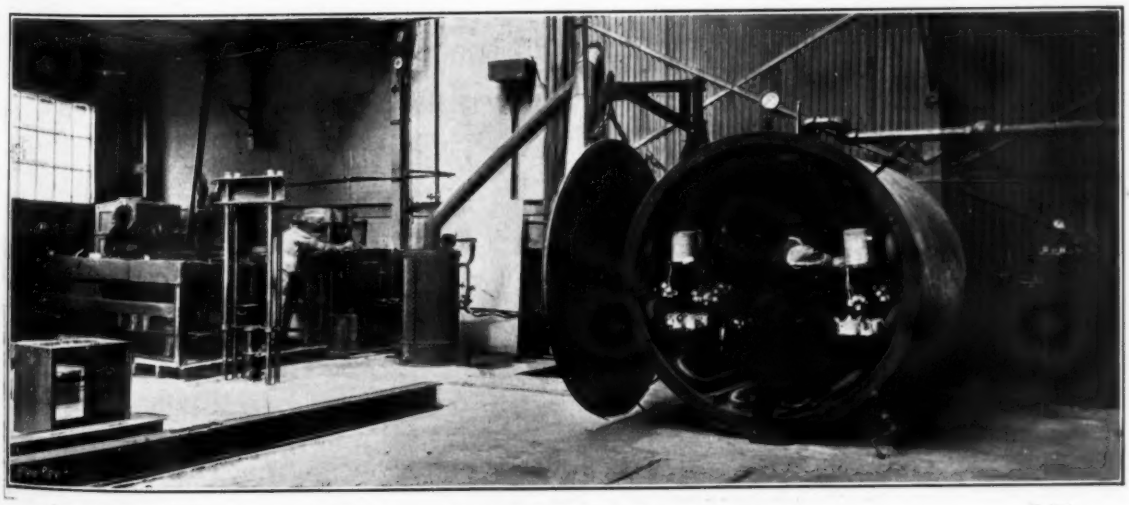


Fig. 4.—Impregnating Plant and Moulding Presses.

Messrs. Ferguson, Pailin's Switchgear Works.

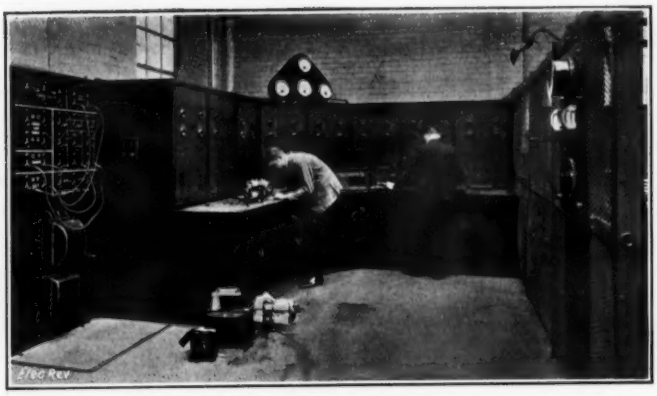


Fig. 5.—Departmental Test Room.

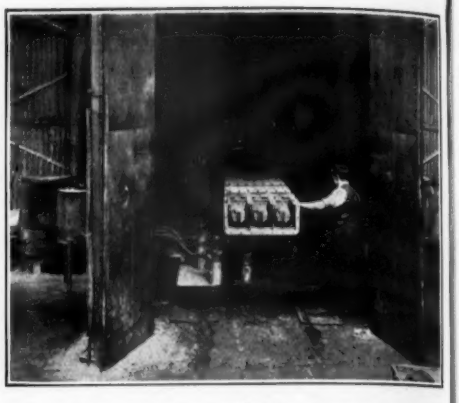


Fig. 6.—Compound-filling Apparatus.

Fig. 7.—Section of Sheet-metal Department, showing Special Machines.

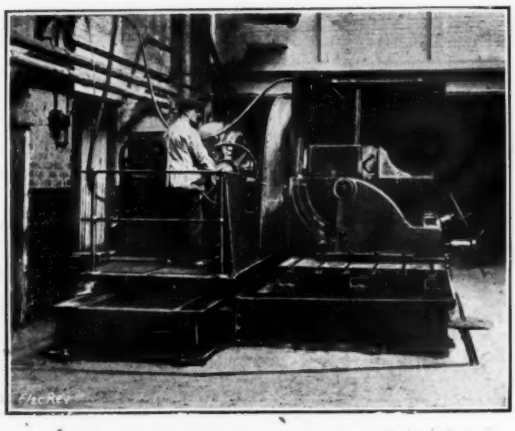


Fig. 8.—Large Grinding Machine, 50-h.p. Motor.

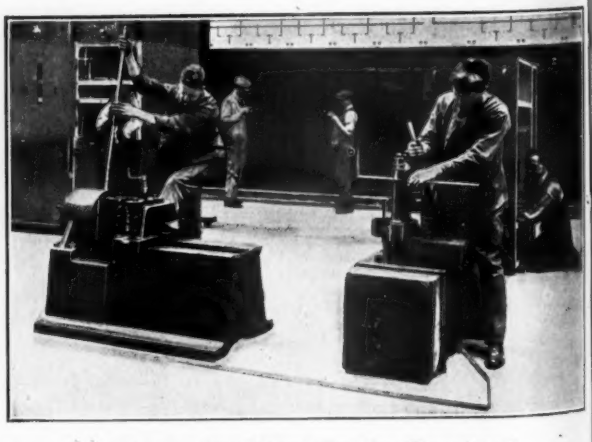


Fig. 9.—Switchboard Erection Department.

Messrs. Ferguson, Pailin's Switchgear Works.

test room. The testing department for instrument current and potential transformers is shown in fig. 5. In addition there is also a special test room in which various routine tests are carried out, and also heating

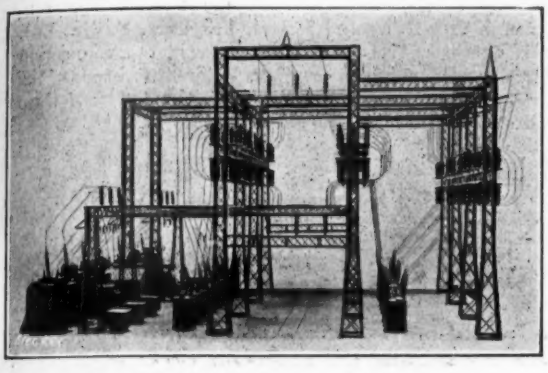


Fig. 10.—Model of "Grid" Equipment.

tests on large heavy-current switchgear. Fig. 3 is a view of this department. The unit on the left is a 4,000-A metal-clad switch. An extension to the pressure-testing plant which is at present under construction will allow tests to be made at 600,000 V.

It is interesting to note that the firm is about to commence a special department for dealing exclusively with small orders which are prone to interfere with the mass production. In addition to chemical, mechanical, and electrical laboratories in the works, there is, under Mr. Pailin's personal charge, an experimental section between which and the electrical "lab." there is close co-operation.

What is perhaps a unique piece of apparatus is a hydraulic impulse tester which the firm is at present putting down. By means of this machine an impulse pressure of 2,000 lb. per sq. in. will be obtainable, and, it is claimed, conditions corresponding as nearly as possible to those prevailing when a breaker is in operation will be available. The objective is to test the top plates and tanks, as well as the oil-throw and the efficiency of the joints.

During a walk through the works some very interesting apparatus was seen in the course of construction.

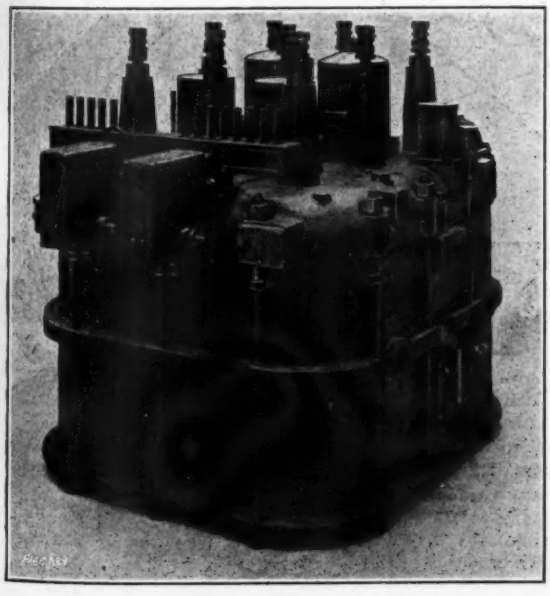


Fig. 11.—Circuit Breaker after Tests in U.S.A.

A particularly striking example of this is shown in fig. 12. It is one of the e.h.p. switch units which the firm is supplying for the new Oldham power station. The remarkable feature in connection with this is its weight, namely, 33 tons for the complete unit. It is designed for operation on a 33-kV circuit. In addition to a number of these huge switches, all manner of other switchgear of more commonplace dimensions for the same station was seen. There is also passing through the works at the present time a number of 33,000-V outdoor sub-station equipments for the North Metropolitan Electric Supply Co., and also equipment to be supplied in connection with the West Midland Electricity supply scheme. The latter is believed to represent the largest order which has been placed for metal-clad switchgear in this country; the gross contract value was £121,000.

In connection with the firm's recent tender for 135-kV "grid" switchgear, a model of an outdoor installation was prepared. Fig. 10 is a reproduction of a photograph of this; it will be agreed that it might easily be taken for a photograph of an actual installation.

No doubt the outstanding product which expresses the firm's individuality is its vertical-type metal-clad

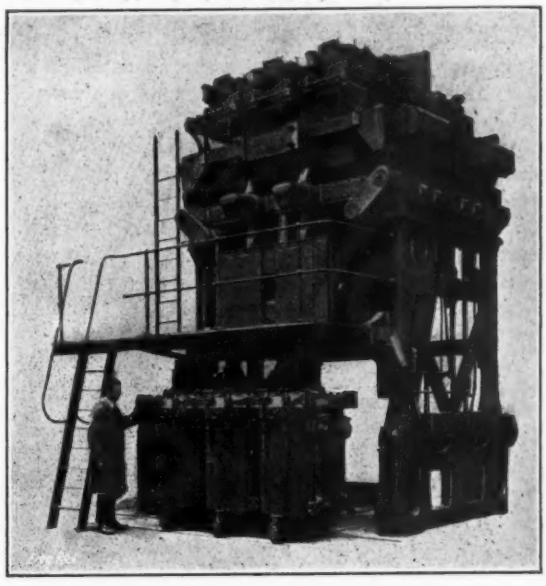


Fig. 12.—33-kV Switch Unit, 33 Tons.

switchgear, and the principals proudly claim that the reception that this class of gear has received has justified the departure undertaken by them in this connection. Last year Mr. Ferguson and Mr. Pailin visited the United States of America and witnessed some rupturing-capacity tests at up to 500,000 kVA at 33,000 and 13,200 V on one of the Company's circuit breakers. The object of the tests was not only to determine the rupturing capacity of the apparatus, but also to prove the efficiency of the double-circuit-breaker arrangement which the firm has adopted for the purpose of bus-bar selection. The breaker was closed against a loading of 29,400 A. Fig. 11 shows the condition of the breaker on its return to the works after the tests. As a result of the experience gained by these tests improvements have been effected in the design of the apparatus.

The offices are in keeping with the factory, from the points of view of organisation and efficiency. There are two drawing offices, one for contracts and one for designs; the latter is not in the general office block, but in the factory immediately over Mr. Pailin's special department.

In these days it may perhaps be safely said that no large industrial concern is complete without at least official recognition and encouragement of social and welfare schemes for the employés. In these the concern is not lacking. A works social and athletic club provides a variety of sports and amusements, and it has the free use of the land at the back of the works, fig. 1. A benevolent fund serves to help the employés in time of

misfortune, and there is also a savings fund which has been established to encourage thrift among the employés. A works and staff canteen is also run by the firm and provides accommodation for all the employés; both the workpeople and staff can obtain meals at nominal charges.

The company started a small factory at Sydney, Australia, about six years ago. Since then this has twice been extended, and at present about 200 workpeople are employed there. It was an interesting coincidence that on the occasion of the visit of which this article is the result, a certificate "First Order of Merit" and a gold medal were received from Sydney; these were awarded to the firm for its exhibit at the Australian Manufacturers' Exhibition in 1927.

In conclusion, reference might be made to the recent working arrangement between the British Thomson-Houston Co., Ltd., and Messrs. Ferguson, Pailin, Ltd. It is particularly interesting to note in this connection that there will not be a complete fusion of interests of the two organisations, and that competition between them will still continue.

"Beam" Wireless Telegraphy.—II.

An investigation of the theory underlying the "beam" aerial system: this involves two principles, *viz.*, the directional effect of spaced transmitting aerials, and the reflection effect of free aerials suitably situated with respect to the transmitting aerials.

By N. WELLS, M.Sc.

THE following contribution forms an appendix to Article I,* and describes the graphical construction of polar curves. It gives, to the engineer not actually specialised, an idea of important principles.

Polar Curves.

Dealing in the first place with a simple vertical antenna radiating an intensity of energy E, the force at any distant receiving station will be proportional to

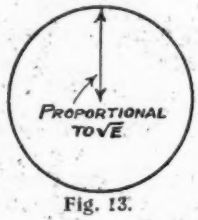


Fig. 13.

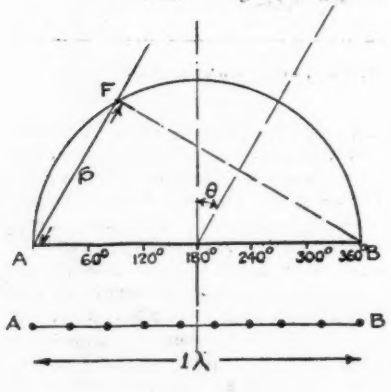
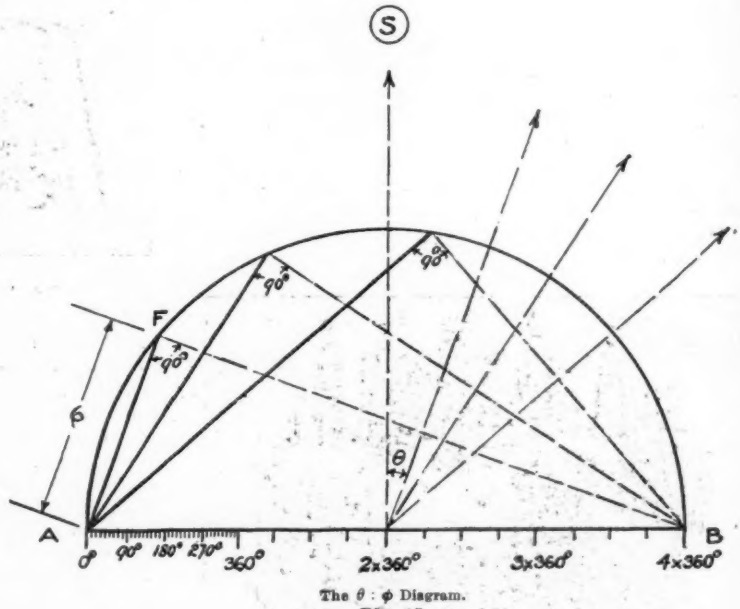


Fig. 14.

$\sqrt{E}$, and the diagram of the force in any direction through 360 deg. will be a circle of radius proportional to $\sqrt{E}$ (fig. 13). Now consider a line of aerials A B (fig. 14), one wavelength wide, all in phase and radiating evenly the total output intensity E. We know that when the direction of the receiving station is in line with A B, the lag amounts to 360 deg., and the instantaneous forces across the system add to zero; also that when the direction is normal to A B, the lag is 0 deg. and the forces combine by simple addition, the resultant being a maximum. For any other direction the corresponding value of lag is measured, as will presently be seen, by the diagram shown in fig. 14, and the problem is: what is the value of the resultant force F along direction θ in terms of F_0, the maximum force?

The actual number of aerials may be three or more, as experience decides, and for practical reasons will be the minimum number creating a sensibly uniform field across the system, but for analytical purposes the number may be treated as if it were increased indefinitely, since this would not affect the field distribution in any way once it becomes uniform; this assumption is a helpful artifice. The force in any direction θ may be conceived as the resultant of a cluster of component vectors, each vector due to an aerial, and if we knew the lag between the extreme vectors and the relative positions of the intervening vectors at any point along the direction, we could determine the resultant force by completing a vector polygon in the usual manner (fig. 17). Imagine the intervening aerials, and hence the vectors, to be multiplied indefinitely, the vector addition becoming the chord of a circle whose arc has a length equal to the simple addition of all the vectors, and whose subtending angle is ϕ, the angle of lag. Thus we have a diagram based on a circular arc of length equivalent to F_0 and subtending angle equal to ϕ, in which the chord corresponds to F.



The $\theta : \phi$ Diagram.

Fig. 15.

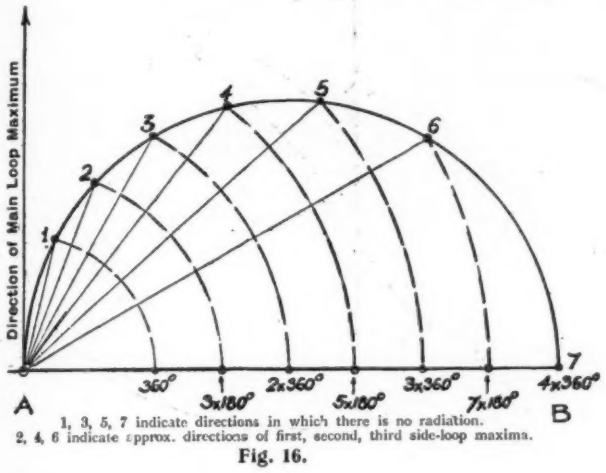
* ELEC. REV., May 25th, 1928.

Determination of Phase.

Referring to fig. 15, where A B represents an aerial system, in order to determine the phase difference along any direction we must find the component along that direction of the total phase difference in the direction A to B; now, the latter difference is constant, so that if we construct a semicircle on A B and draw a line from L in the direction θ then, by the geometry of the figure, A F the length intercepted will be the component of A B in the direction θ; this component is termed ϕ, since phase difference is generally measured as an angle.

The method may be employed for finding the directions of zero radiation for various widths of system, since we have simply to find where the lengths A P = one wavelength, or 360 deg., A O = two wavelengths, or 2×360 deg., &c., cut the semicircle drawn on A B. Thus, if fig. 16 represents a four-wavelength system, A1, A3, A5, and A7 indicate the directions of the first, second, third, and fourth zeros. The approximate directions of side-loop maxima are indicated by A2, A4, and A6.

There are now sufficient data to construct from first principles a polar curve in the case of a system of aerials one wavelength wide. From the diagram (fig. 14) we may find ϕ for any direction and draw a circle such that the portion of circumference subtended by ϕ represents the maximum force F_0, then scaling off the chord we have the force F along the direction *measured as a fraction of* F_0. It will simplify matters if we reverse the process and determine the various values or θ for given values of ϕ; thus, in fig. 18 sixty degrees has been adopted as a convenient division for the angle of lag, and the six corresponding values of θ have been drawn out accordingly. Next construct a circle whose circumference is approximately some whole number, and for this purpose a diameter of 19.1 cm. is convenient (fig. 19); divide this up into six equal segments, then, if the first sixth of the arc corresponds with F_0, which we have made 10 cm., the first chord will correspond with F_1, the force along that direction for which the ϕ value amounts to 60 deg. In order to measure F_2 directly, we should reconstruct the circle to half size, since 10 cm. of arc now subtends 120 deg., but it is preferable to construct one circle and to scale off half the second chord, one third of the third chord, &c., obtaining in this manner values for F_1 to F_6, measured as fractions of F_0; the value of F_6 is, of course, equal to zero. If the values are marked off along the six directions shown in fig. 18, and a fair curve drawn through the points, one quadrant of the polar curve will result, and since the three remaining quadrants are identical, the curve is easily completed.



1, 3, 5, 7 indicate directions in which there is no radiation.
2, 4, 6 indicate approx. directions of first, second, third side-loop maxima.

Fig. 16.

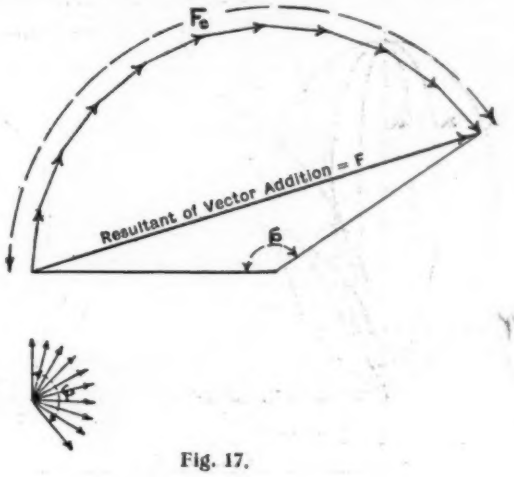


Fig. 17.

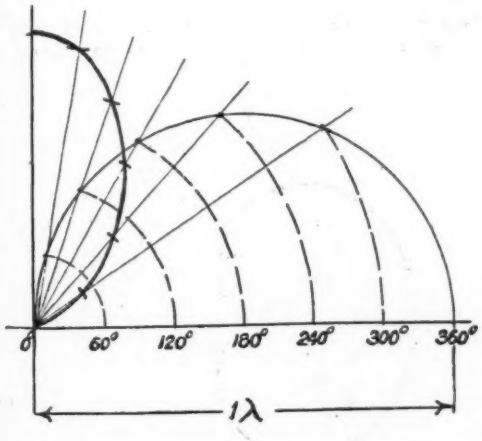


Fig. 18.

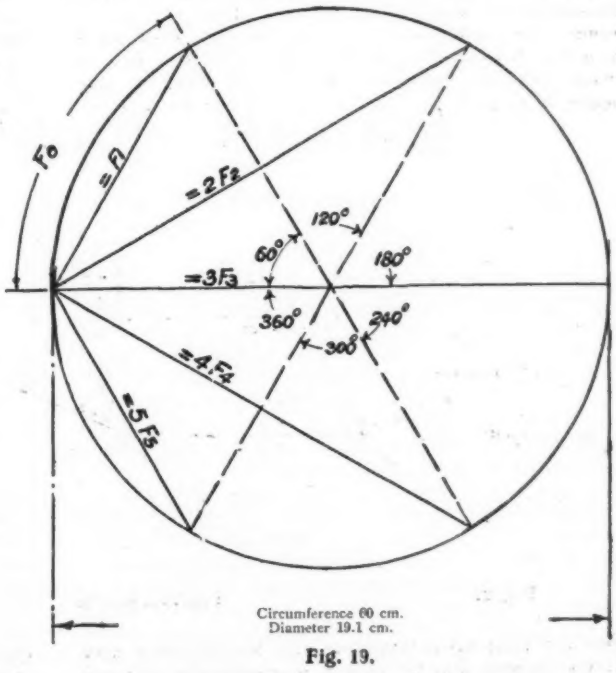


Fig. 19.

Smaller values than 60 deg. can be chosen, but this is a convenient division, and gives a sufficiently accurate approximation for most purposes.

General Case.

The foregoing argument is not confined to a system one wavelength wide, but is in fact generally applicable. In the case of the $\theta:\phi$ diagram, the base may denote any number of wavelengths; in the case of the circle diagram, the first arc may be 60 deg., or 420 deg., or 780 deg., &c., while the first chord may denote F_1, or $7F_7$, or $13F_{13}$, &c., and the second chord denote $2F_2$, or $8F_8$, or $14F_{14}$, &c. (note that the values of F_6, F_{12}, F_{18}, &c., are always zero.)

Consideration of the circle diagram makes it evident that an aerial system may have other and diminutive loops, there being one such loop per quadrant for each wavelength in width after the first; thus, a "beam" system four wavelengths wide has three side loops, while a system ten wavelengths wide has nine, &c., and all values of F for values of lag greater than 360 deg. relate to these loops. If they are plotted for any system and their areas compared with the main-loop area, it will be seen that the energy represented is unimportant. For all practical purposes then, we may confine our attention to the main loop, and our graphics are simplified to the general $\theta:\phi$ diagram and the simple circle diagram covering the first 360 deg. of phase difference.

In fig. 20 the three main loops are filled in, corresponding to systems one, two, and four wavelengths wide. It will be apparent that the relation between "relative force" and "lag" is constant, but for a given relative value of force the direction varies with differing widths of aerial systems; in fact, this is the essence of the "beam" method.

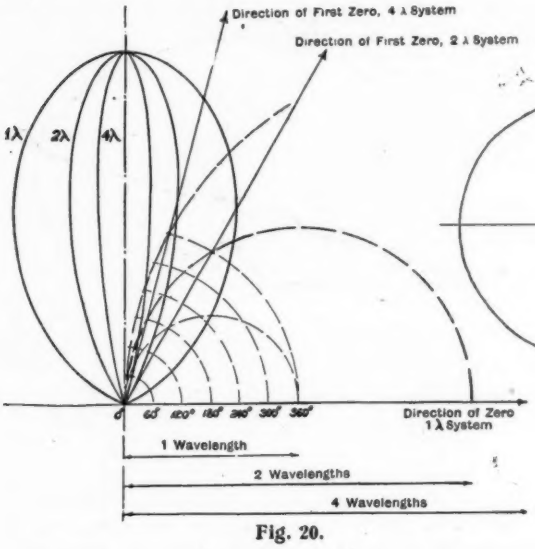


Fig. 20.

Numerical Value.

For purposes of graphic comparison the three curves of fig. 20 have been treated as of constant maximum force, and the areas in each case correspond to the energy output necessary to create this value of electric force. It is thus possible by comparing various loop areas for various widths of "beam" to determine the variation in energy output necessary to create a given normal force. It will be found that the loop for a *reflected* "beam" system one wavelength wide has an area approximately 6.0 times less than a circle of equal radius, the circle corresponding to the polar curve of a vertical aerial of similar form and height radiating the required force in all directions. Again, a "beam" system four wavelengths wide develops a loop of area four times less than that developed by a one-wavelength system. The general rule of comparison, on the basis of a single similar vertical aerial is 6.0 times increase of energy per wavelength in width.

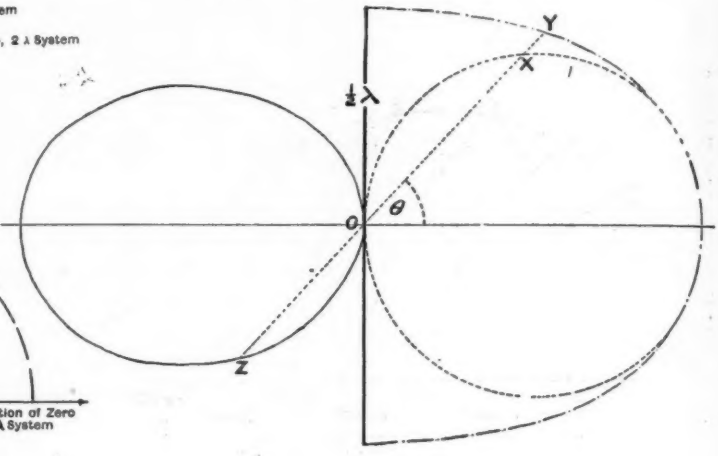


Fig. 23.

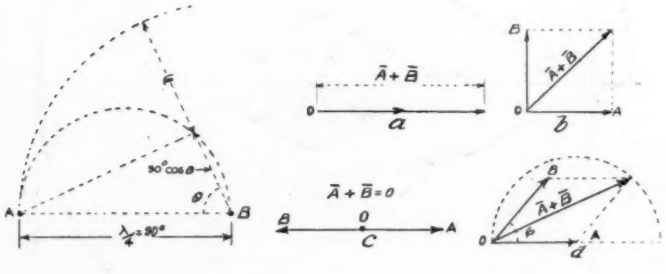


Fig. 21. Fig. 21a, b, c, d.

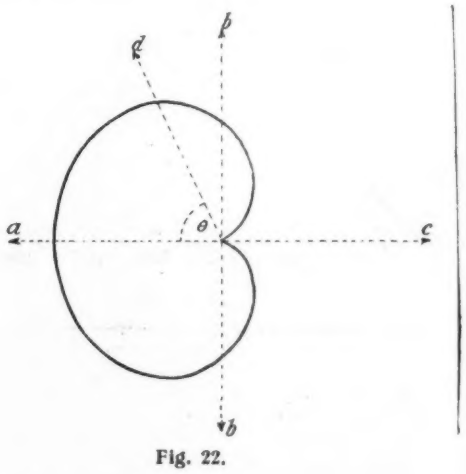


Fig. 22.

Constant Output.

The method of adhering to a constant normal force has the advantage of simplifying computations, but it is interesting to regard the problem from the reverse aspect. Thus, take the case of a constant output of

energy E; for a system one wavelength wide whose component aerials each radiate energy e, the force in a normal direction will bear some relation to $\sqrt{E}$=sum of $\sqrt{e}$, and we may write it as $K\sqrt{e}$. If we now double the width, we double the number of component aerials, so that each now radiates an intensity of energy $e/2$, and the normal force becomes $2K\sqrt{e/2}=K\sqrt{2e}$, corresponding to an intensity of energy in the normal direction twice as great as the original intensity.

Similarly, for a system four wavelengths wide the normal force totals $4K\sqrt{e}/4=2K\sqrt{e}$; note that in this case the force has increased to double its original value, corresponding to an intensity of energy in the normal direction four times as great as the original intensity. This implies that as the system is extended in wavelength units, the polar curve is squeezed up in measure to the narrowing angle of the first zero. For the case of a system four wavelengths wide the shape of the curve, whilst retaining approximately constant area, has been so elongated and narrowed that the principal axis is twice the length of that corresponding to a system one wavelength wide.

Polar Diagram of Simple Reflected System.

The construction of the diagram for a single transmitter with a single reflector spaced one-quarter wavelength behind it follows from the explanation given under the heading of "Reflection" (see Article I). In the system A and B (fig. 21) the currents in the transmitter A and reflector B are equal, but relative to A and regarded from a point in front of A, the current in B lags by 90 deg. in respect of distance A B; by 180 deg. in respect of coupling effect, and by 90 deg. in respect of distance B A; the result of the vector sum is indicated in fig. 21a, while for other directions the results are seen in figs. 21b, 21c, and 21d. The last one is the general case wherein the lag equals $-(90 \text{ deg.} + 180 \text{ deg.} + 90 \text{ deg.} \cos\theta) = 90 \text{ deg.} - 90 \text{ deg.} \cos\theta$, and the complete polar curve is shown in fig. 22. This is an important curve and might aptly be termed the "Kidney Diagram," or its Latin equivalent.

Polar Diagram of an Extended Aerial System.

The development of the polar curve resulting from two similar systems of aerials spaced any distance apart may be simplified by a principle enunciated by E. Green as follows: first obtain the polar curve for one of the systems, then that for two single aerials separated by a distance equal to that between the two systems: the product of these two curves will be the required polar curve for the complete system. In the present instance we are concerned with the polar curve for the reflected Franklin "beam," and from the foregoing it follows that it will be the product of the diagram of fig. 3 by the diagram of fig. 22, the result approximating very closely in shape to one half of fig. 3 (see Article I).

Vertical Polar Diagram.

The graphical construction of a vertical polar diagram is interesting, since the two stages involved help to a clearer perception of the nature of aerial radiation. First, construct the ordinary diagram for a system one-half wavelength long radiating in its own plane; this involves a diagram as per fig. 15, with base scaled to represent 180 deg., also a diagram as per fig. 16 from 0 deg. to 180 deg. in steps of 30 deg.; the result is the dash outline in fig. 23. This is, of course, the polar curve for a system one-half wavelength wide, but in the case of the vertical aerial we have to remember that radiation is vertically polarised and normal to the length of the aerial, thus intensity of radiation at an inclination to the normal plane will be in simple cosine proportion to the angle of inclination. It follows that in order to obtain the intensity of polarised radiation along any inclination θ, we multiply the intensity of normal radiation by the cosine of θ: thus, in fig. 23 the length O X is multiplied by O Y and equals O Z. The complete curve is seen to the left of the figure, and represents in section the vertical polar diagram for a half-wavelength aerial; since current distribution is sinusoidal, and not uniform as assumed above, the actual curve is slightly less sharp than shown.

High-Frequency Heating.

A comparative review of the methods of generating the currents necessary for supplying high-frequency furnaces.

By L.C.G.

In recent years there has been considerable development in the use of high-frequency current for industrial processes. Previously, electric-furnace work and electrical industrial heating generally had been almost exclusively carried out by means of the arc furnace and the induction furnace, with a smaller amount of work carried out by the resistance furnace or oven. There are many processes in this field which could be advantageously carried out by the use of high-frequency current, and there are many more which demand exclusively the use of high frequency and which have during the last few years been more or less intensively developed. Among the salient advantages of high-frequency heating are the following: (1) the material that is being heated does not suffer in any way through oxidisation or burning, and (2) extreme accuracy of control is possible with high frequency as against only approximate control with other methods.

There is no doubt that high-frequencies would have been more generally used, but for the difficulty of obtaining such frequencies. Several methods of generation are known, all of which are relatively expensive as compared with the plain arc furnace. For instance, there is the Poulsen arc generator, the Tesla spark discharge generator, and, more recently, the thermionic-valve generator. For medium-frequency work, say, about one thousand cycles per second, the rotary type of generator possesses many advantages.

Considerable progress has been made latterly in the use of high frequency in fields where it has no competitor; for instance, in the production of high-grade alloys. The development of high-permeability alloys has given the high-frequency furnace a considerable fillip, while in the ceramic industry parallel developments are taking place.

The use of middle frequencies such as can be generated conveniently by rotating machinery is largely confined to the production of magnetic materials where the hysteresis loss is comparatively high, but for general use among non-ferrous metals, ceramics, and so on, a higher frequency is usually desirable, and something of the order of 20,000 to 200,000 cycles is called for. It has already been noted that such frequencies can be generated commercially by three methods—Tesla, Poulsen, and thermionic valve.

The Poulsen method has made little or no progress, and, technically, there does not seem much to choose between this and the Tesla method. Both are somewhat

unstable in operation, and the control of their outputs can be effected only approximately. The efficiency is not high.

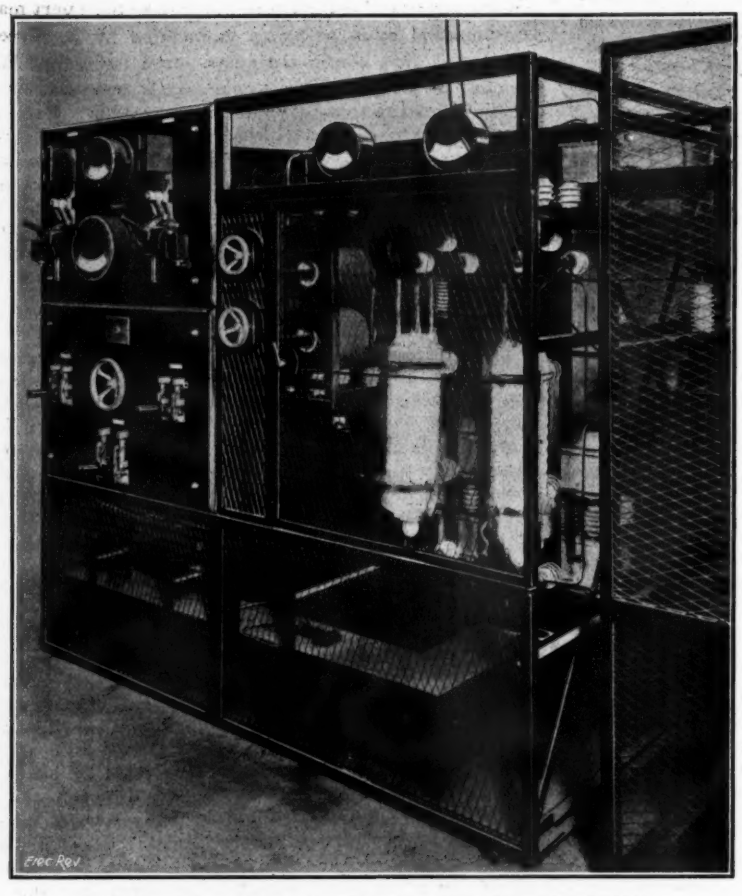


Fig. 1.—Thermionic-valve High-frequency Generator Outfit.

The Tesla type of generator has made considerable progress in the United States, on the Continent, and in this country, the development being largely carried out by the Ajax-Northrup Company and the concerns associated with it. Generators of this type have been installed in a diversity of places ranging from the Royal Mint to some of the large steelworks. The technical principles involved are quite well known. Briefly, current is taken from the public supply mains, and is then converted to a.c., if necessary, and stepped up to a suitable voltage to charge a bank of condensers. These periodically discharge through a fixed spark gap of the mercury-bath type; a plain cylindrical inductance is used in conjunction with the condensers to adjust the oscillation constant to the required value. Regulation of a generator of this type can be conveniently carried out by means of a choke in the primary side of the step-up transformer. The output is of rather a fluctuating character, due largely to the inherent vagaries of the spark gap, and the wave trains are of a highly damped character, *i.e.*, consisting of a series of wave groups having a predominant frequency equal to that determined by the condenser and inductance. There is a considerable amount of energy distributed over the side frequencies, characteristically produced by any spark-gap generator.

The valve-type generator, on the other hand, produces continuous waves; that is, all the energy is concentrated on one frequency which does not vary either cyclically or in between adjustments. The advantages of a continuous wave of this character are: (1) that the generator can be designed exactly, because the voltage, frequency, current, and other factors are quite definite and controllable; (2) as the energy is concentrated on one frequency, it can be controlled and applied with precision; and (3) partly because of (2) the efficiency is comparatively high. A modern arrangement of this type of generator is illustrated herewith in fig. 1. This apparatus is capable of giving an output of 80 kW at any frequency between 10,000 and 50,000 cycles. Temporarily, it is arranged to give 20 kW with an efficiency of 65-70 per cent., which, it will be understood, is a good performance.

In order to balance the load from the a.c. mains, it is usual to use a minimum of two valves for a generator of this type; then each valve handles alternate half cycles, so that the generator can be connected directly to the a.c. supply without the necessity of any rotating machinery or similar apparatus for providing the plate supply. The cathodes are also fed directly with a.c. The high frequency is produced by the valves and is fed through a high-voltage condenser, so making the output quite safe to work upon, there being thus no danger of shock. The elimination of the spark gap and the rotating plant necessary with other methods of generating high frequency, and the provision of a low-voltage and perfectly safe high-frequency furnace coil, it will be apreciated, are great advances.

The heating proper is carried out either by utilising the high-frequency inductance coil, fig. 2, as a common oscillatory circuit coil and furnace coil, or for special work necessitating the heating of pieces of special shape (usually semi-finished material), coils can be built to suit the shape of the object with an increase of efficiency and

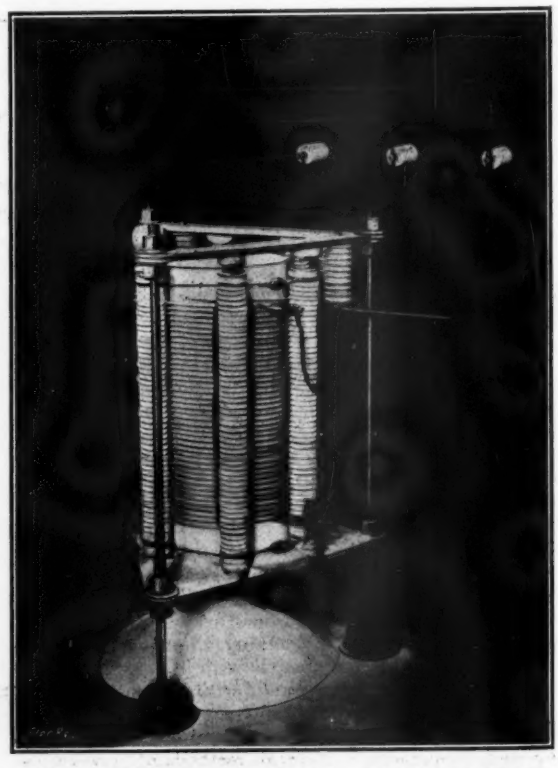


Fig. 2.—High-frequency Furnace for General Work.

a saving of heating time. One of the great advantages of this apparatus is that there are no

moving parts whatever, the valves taking alternating current from the mains The envelopes of the valves are of silica, which has many advantages, not the least being that thermal and expansion troubles are unknown with this material, so that there is no danger of breakage. Valves of this type are employed throughout the British Navy, because of their great robustness and their ability to withstand gun-fire and other shock. The standard test for a valve of this character is to take it packed in its transport case and drop it from a considerable height.

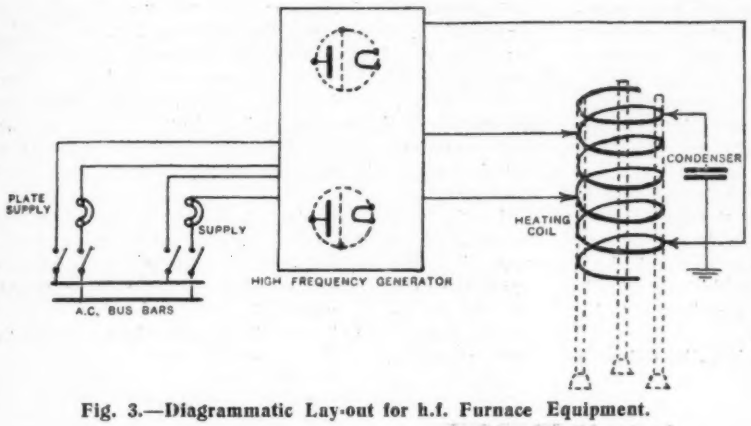


Fig. 3.—Diagrammatic Lay-out for h.f. Furnace Equipment.

Another advantage of using silica is that it has high diathermy, which means that all the heat generated internally can be driven through the silica envelope without the necessity for any of the external water or oil cooling necessary with other methods. The output of this generator can be regulated from zero up to full load in the most minute steps with exactness, while the frequency can be regulated with precision over a considerable range. The generator can be split into halves and one half only used. This particular generator was installed in 1925 and has since operated without any adjustments and without any breakdowns. There has not been a valve failure of any character. In all, the valve-running hours are 900. Filament renewals will, of course, be necessary from time to time, and the valves are arranged so that they can be "decapitated" and a new filament added. The cost of filament renewal is less than a quarter of the cost of a new valve. Valves of this character capable of giving the output referred to, *i.e.*, 80 kW, cost approximately £100.

In crucible work, with the furnace on full load, a temperature of 4,000 deg. F. is easily reached, and in normal working this temperature is attained within fifteen minutes. With smaller loads, or with differently-shaped objects, even better results can be obtained. On a smaller and a different sort of job, when using a small crucible—much too small for the inductor coil—a block of graphite of 32 in. cube was brought up to 3,200 deg. F. within fifteen minutes. The input to the generator on a small load of this character automatically adjusts itself to the load in much the same way as an electric motor, and in this case the a.c. load was about 8 kW.

This apparatus has been used in the production of various metals, carbons, and ceramic materials with marked superiority over all methods previously tried. It is quite automatic in working, and after adjustment to a given output can be left to run indefinitely. It will thus be seen that the valve type of generator has considerable advantages over other forms, and that there need be no lingering fears as to the fragility of this class of apparatus. Fig. 3 shows diagrammatically the lay-out for a h.f. furnace installation with a thermionic-valve generator.

Engineering Laboratory Equipment.

A plea for the provision of adequate and suitable apparatus in our technical college laboratories.

By AN ENGINEERING LECTURER.

THE present tendency in the world of technical education is one of construction and reconstruction. Within the last five years or so quite a number of new schools and colleges have been built, while more still are overhauling their laboratory equipment, and, where necessary, making alterations and additions. The immediate future does not indicate any diminution of activity in this department of the educational world.

The equipment or re-equipment of the laboratory of a technical college is a problem deserving the most serious consideration. It is not a rare experience, especially in the older technical schools, to find apparatus which is quite unsuited for the purpose in view. There is no desire to wholly condemn the authorities who permitted the installation of such equipment, for it is realised that in many cases the apparatus was possibly a gift or part gift of some well-wishing manufacturer; one does wish, however, that those responsible at the time had been strong enough, both morally and financially, to install only the most suitable equipment. Since the problem of suitable laboratory equipment is so much to the front to-day, a brief consideration of some of the principles at issue may be useful.

Before passing on to the actual selection of plant, it is necessary to have a very clear idea of the function of an ordinary technical laboratory for the training of students. Very briefly, the chief purpose of an engineering laboratory may be put thus: it is to enable students to experimentally verify known laws, to examine the actual working of various machines, and to study the application of fundamental principles. Unless the elementary objectives of the school laboratory, as here set forth, are easily attainable, then, whilst the practical training of the students may not be a complete failure, the work is certainly not being carried out with a maximum of efficiency. Keeping these objects in mind, we may view the problem from a number of angles.

It is most important that in carrying out laboratory work each student should have plenty to do (within his capabilities, of course), and further, his share of the work should form a large and definitely related proportion of the whole. To this end it is necessary to keep the size of the apparatus strictly within limits. Take, for example, the question of laboratory training in the operation of prime movers, *i.e.*, steam, oil, and gas engines, such as forms part of the normal work of any of our universities. Tests on the machines are usually run by the students working in groups, each man being allotted a definite task. Now, surely it must

be fairly apparent that there is only a minimum of educational value in instructing a student to spend an hour in simply reading one or two meters. By all means let him read the meters—it is important—but it is more important still that he should see a great deal more of the experiment than that. The amount of information a student obtains from a test of this nature appears to vary, within limits, inversely as the size of the plant. If the plant is fairly small, say a 40- or 50-h.p. marine-type engine, capable of being completely run and tested by about five students under supervision, the men are likely to learn a lot more than if the plant is considerably larger and requires the assiduous attention of about twenty students to satisfactorily perform the test. Working on the small engine, each student is able, not only to do his own particular job, but also to see what his fellow students are doing, and correlate his part of the test with theirs. In the case of the larger plant, whilst the student may possibly see something of what those near him are doing, it is certainly more difficult to obtain a comprehensive and balanced idea of the whole test. It may be objected that the students can keep changing positions and so permit each man in turn to observe the operation of a different part. This is seldom practicable. In the time available it is usually as much as can be accomplished to post each man to his allotted task and get the test through.

The author well remembers in his college days a certain test on an air compressor. The plant was small as commercial installations go—only some 25 h.p.—but it was rather badly laid out. About twenty or more students were posted at different points of the installation, and the writer was fortunate in finding himself on the compressor itself; but his sympathy went out very sincerely to two fellow-students who spent a couple of hours *outside the building* working the valves and taking the temperatures of the receivers. Hence I think it may be definitely said that nothing is to be gained, whilst much may be lost, by having apparatus above a certain size.

A second point of importance, and one which is often neglected, is to see that the apparatus is not unduly complicated. I am referring, of course, to appliances used exclusively for tutorial purposes, and not in connection with research work. The primary work in the laboratory is the testing and application of principles, and few students find it helpful if there are two or three pet devices on the machine which obscure its normal performance.

To almost every student the work in the laboratory comes as the most fascinating part of his school training. It is impossible to spend too much time and care upon the organisation of the work there performed. On the contrary, every effort to make the work of the students more clear will undoubtedly meet with its just reward.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The Electrical Refrigeration Campaign.

The Electrical Refrigeration Campaign, which is to be held from June 8th to 25th, will be inaugurated at a luncheon at the Hotel Cecil on Thursday next, June 7th. The price of the tickets is 6s. 6d. each, and they can be obtained upon application to the British Electrical Development Association, 15, Savoy Street, W.C.2.

Payment by Results in the Engineering Industry.

One of the subjects discussed at last week's conference of the National Committee of the Amalgamated Engineering Union at Southport, was that of payment by results. Mr. J. Allison (Preston) moved a resolution providing that, as 75 per cent. of the Union membership was already working upon some system of payment by results, the Union should recognise the system and negotiate for a national agreement of control. During the subsequent debate it was stated that considerable difficulty and confusion had arisen owing to the absence of an agreement regarding the control of systems of payment by results. The resolution was carried by a large majority.

The Leeds Electrical Club.

A meeting of the members of the Leeds electrical trade was held on May 21st, at the Leeds Corporation electrical showrooms. It was decided that an Electrical Club should be formed as a centre for the social activities of the whole of the electrical trade in the district. In the course of the meeting it was pointed out by Mr. J. Douglas Green, who acted as chairman, that up to the present the electrical trades had organised cricket matches and had also held socials and dances with success, but it was felt that there was a need for a central club house to co-ordinate the social life of the trade. Mr. W. B. Woodhouse, general manager of the Yorkshire Electric Power Co., has been invited to become the first president of the new club, and chief engineers of other power companies and municipal undertakings have also been invited to become vice-presidents. A strong committee representative of the manufacturing, wholesale and contracting businesses has been formed, and will proceed at the earliest possible moment to obtain suitable premises worthy of the club. Applicants for membership from persons actively connected with the electrical trade should be made for the time being to Mr. S. T. Needham, 10, York Place, Leeds.

Social Events.

The combined staffs of the Manchester, Liverpool, Leeds, and Sheffield branches of the General Electric Co., Ltd., held their annual picnic on May 12th at the Palace Hotel, Buxton, when upwards of 300 sat down to an excellent luncheon. During the afternoon a large party went for a circular motor run covering some sixty miles of the most beautiful scenery in Derbyshire. The remainder of the party filled in their time according to their varied tastes in rambling, tennis, bowls, &c. After dinner there was a dance in the hotel ballroom.

Mr. L. C. Gamage, chairman of the G.E.C. Football Club, presided at the presentation of the trophies won in the First and Second Divisions of the West End Amateur Football Association at the Cannon Street Hotel on May 11th. He was supported by Mr. H. W. Roberts (G.E.C.), Mr. Trevor A. Bowen, Mr. W. Randall (Marconi Athletic Club), Mr. C. J. Bartlett (General Motors), and other gentlemen. It was stated that an intermediate division had been formed for next season, and that challenge cups had been presented by Mr. L. C. Gamage (G.E.C.) and Mr. C. J. Bartlett (General Motors) for competition.

Dundee and Foreign Cables.

At last week's meeting of the Dundee Electricity Committee, Mr. D. H. Bishop, the general manager, reported that tenders for Dutch, Belgian, and German cables amounted to £3,258, whereas the British offers amounted to £4,098, a difference of £840 in favour of the foreign cables. Councillor Carnegie said that the foreign tenderers made some allowance for returned drums which brought the difference in price up to £935. He maintained that British manufacturers offered their cable in the Continental market at lower prices than they tendered to the home purchaser. He believed that if the Corporation was at liberty to approach any of the reputable cable manufacturers in Britain to-day without having to advertise for quotations they would be able to buy very much cheaper. The material offered by the firms mentioned in Mr. Bishop's report was all that was desired. The Committee decided to accept the lowest offers which were those of Messrs. Hogan & Wardrop, for Dutch cable; the A.C.E.C., for Belgian cable; and Power and Lighting Cables, Ltd., for German cables.

Changing-over and Income Tax.

Regarding representations made to the Inland Revenue Department as to the income-tax allowance on the cost of changing over consumers' installations from d.c. to a.c., the Glasgow Corporation Sub-Committee on Finance has agreed to acquiesce in the decision of the Board of Inland Revenue to make an allowance in respect of the replacement of cables and in respect of generating plant, &c., discarded at various stations at which generation has been discontinued and replaced by similar plant at Dalmarnock, and to disallow expenditure on alteration or replacement of consumers' plant or fittings consequent upon the alteration of the system of supply.

Bankruptcy Proceedings.

H. S. STEPHENS and S. WEILL, trading as Stephens & Weill, 55, Great Eastern Street, E.C.—The affairs of this firm came before Mr. Registrar Mellor on May 22nd at the London Bankruptcy Court, upon the application of the debtor Stephens for an order of discharge. Mr. V. Armstrong, Official Receiver, reported that the public examination of the applicant was concluded last March, but that of the debtor Weill had stood adjourned for further particulars. In the absence of Weill his examination was further adjourned until July 10th. The firm failed in August, 1927, with joint liabilities of £36,770; the assets, valued at £1,487, had so far realised £1,006, whilst a further sum of £200 was expected to be received. A first and final dividend of 5d. in the £ would probably be paid. The business was started in May, 1922. At the commencement Stephens had a capital of £157, but Weill was insolvent by approximately £1,000. The balance sheet for 1925 showed a net loss on the trading of £24,657, in spite of which Stephens drew £12,919 and Weill £16,742. The subsequent trading to the date of the failure resulted in a further net loss of £5,634. The failure was attributed to losses by bad debts, loss by selling slightly below cost price during 1926 and 1927, excessive drawings of the partners, and loss by reason of their having financed some German manufacturers. The application was opposed by the Official Receiver on the grounds of insufficiency of assets to equal 10s. in the £ on the amount of the liabilities, trading with knowledge of insolvency, and contributing to the bankruptcy by unjustifiable extravagance in living. His Honour imposed a further suspension of two years.

W. G. HOLMES, wireless and electrical engineer, 43, Walcot Street, Bath.—The first meeting of creditors was held on May 23rd at the Official Receiver's office, Bristol, when the case, being a summary one, was left in the hands of the Official Receiver as trustee of the estate. Debtor attributed his failure to lack of capital and bad trade. The ranking liabilities amounted to £221, with a deficiency of £132.

A. E. CROSS, electrical engineer, 8, Cooksley Road, Redfield, Bristol.—Receiving order made May 22nd, on a creditor's petition.

A. L. ASTILL (The Eastern Wireless Supply Co.), wireless engineer, 362, High Street, Lincoln.—Receiving order made May 23rd, on debtor's own petition.

R. G. ROBERTS, electrical engineer, Magnet House, College Road, Upper Bangor.—First and final dividend of 2s. 1½d. in the £, payable June 8th, at the Official Receiver's office, St. Peter's Churchyard, The Cross, Chester.

W. H. GREENALL (Hampton Electrical Co.), electrician, Newerne Street, Lydney, Glos.—Supplemental dividend of 1½d. in the £, payable June 6th, at the Official Receiver's office, 34, Park Place, Cardiff.

Company Liquidations.

ELECTRIC PRODUCTIONS CO., LTD., late 32, King Street, W., electrical engineers.—A meeting of creditors was held on May 21st at the offices of Messrs. Leonard, Dickinson & Co., 82, Victoria Street, S.W., when Mr. George Dickinson, the liquidator of the company, presented a statement of affairs which disclosed liabilities of £1,680, all due to unsecured creditors. There were net assets of £823, leaving a deficiency of £858. The company was formed in January, 1919, with a nominal capital of £1,000, later increased to £2,000. Shares were issued amounting to £1,900, and of that amount £1,800 was for cash. The shareholders were Messrs. A. & R. Hart and Mr. A. E. Abrahams. The two directors were Messrs. Hart. From the commencement the company had never made any profit in any one year. No directors' fees had been paid since 1923. The lease of the premises was dated March, 1922, for a period of 21 years, at a rental of £200 per annum. When the shareholders were discussing the question of voluntary liquidation, it was found that if the company became insolvent or compounded with its creditors, the lessors could re-enter the premises. The directors therefore decided to assign the lease to themselves, and they paid the company £100 for it. The creditors decided that the meeting should be adjourned. The creditors include:—

	£		£
Hudson & Co.	647	Z Electric Lamp and	
Hart, A.	560	Supplies Co., Ltd. ...	150

HALLIWELL & GOOD, LTD., electrical engineers, Manchester.—A meeting of creditors was held on May 23rd, at the offices of the liquidator, Mr. Edward Miller, C.A., 5, Cross Street, Manchester. The statement of affairs submitted showed liabilities of £1,217, of which £687 was due to the trade and £530 to loan creditors. The net assets were £913, leaving a deficiency as regarded the unsecured creditors of £304. The issued capital of the company was stated to be £3,000. The company was formed in 1919 with a share capital of £3,000, and until 1924 traded profitably, but since then small net losses had been sustained. The liquidator stated that he had been approached by several people who were prepared to make offers for the purchase of the business as a going concern, subject to the landlords agreeing to accept them as tenants. He was therefore hopeful that the figure mentioned in the statement of affairs as the value of the assets, would be obtained. It was resolved to confirm the appointment of Mr. Miller as liquidator, while an advisory committee was also nominated, consisting of the representatives of Messrs. James Atherton (Sicamore), Ltd., and Baxendale & Co., Ltd., and Mr. A. T. Eaves. The following are creditors:—

	£		£
Atherton, James (Sicamore), Ltd.	110	Henley's, W. T., Telegraph Works Co., Ltd.	31
Baxendale & Co., Ltd. ...	271	Wholesale Fittings Co., Ltd.	24
Ferranti, Ltd.	25	Berry's Electric, Ltd. ...	20
General Electric Co., Ltd.	26		

J. BRENT & CO., LTD., 71, Queen's Road, Watford, Herts.—The winding-up order herein was made in January last on a creditor's petition. The statement of affairs shows ranking liabilities of £1,182, against assets of £36, leaving a deficiency of £1,145. The issued capital of the company is £776; the total deficiency is thus £1,921. The failure is attributed to lack of capital and insufficient profits to pay overhead charges and working expenses. The company was registered as a private company on July 26th, 1923. The promoters were Mr. A. H. Cooper and Mr. S. F. Rous, and the company was formed for the purpose of carrying on business as electricians at Watford. In November, 1925, the company extended its business by purchasing the goodwill with a small amount of stock-in-trade of an electrician's business carried on at a workshop at Queen's Road, Watford, for £200, which was satisfied by the allotment of 100 fully-paid £1 shares in the company to each of the vendors. The business was then transferred to these premises and a manager was appointed. The company also at the same time opened a branch shop at South Dunstable. This branch was unsuccessful, and in July, 1927, all the assets there were sold for £50 by the sheriff under an execution, and the premises were given up. As a result of the first meetings of the creditors and contributories the Official Receiver remains liquidator.

RICHARD JOHNSON & NEPHEW, LTD.—A meeting of creditors is called for June 6th, at 60, Spring Gardens, Manchester. Particulars of claims are to be sent to the liquidator, Mr. H. Fielden, 104, King Street, Manchester, by July 9th. The winding up is purely formal for the purpose of a sale of the goodwill and certain of the assets of the company with a view to the formation of a new public limited company. All creditors of the company have been, or will be, paid in full.

BROUGHTON COPPER CO., LTD.—Winding up voluntarily. Liquidator, Mr. T. F. Grundy, 4, Broad Street Place, E.C.2. A meeting of creditors is called for June 4th, at the liquidator's offices. Particulars of claims by June 12th. This notice is purely formal, as all creditors have been paid in full.

WATERHOUSES (ELECTRICIANS), LTD.—A meeting of creditors is called for June 1st at the Grosvenor Café, Station Road, Castleford. Particulars of claims by June 22nd to the liquidator, Mr. F. W. Hanson, Court Chambers, Jessop Street, Castleford.

NEON LIGHTS (1923), LTD.—Winding up voluntarily. Liquidator, Mr. G. S. Groundwater, St. Lawrence House, Trump Street, E.C.2. A meeting of creditors is called for June 5th at the liquidator's offices.

RADIO INVESTIGATIONS, LTD.—Winding up voluntarily. Liquidator, Mr. F. H. W. Hope, Pinners Hall, Austin Friars, E.C. A meeting of creditors is called for June 6th at the liquidator's offices.

CECIL HODGES & CO., LTD.—First meetings of creditors and contributories June 7th, at Carey Street, W.C.

Works Visit.

The electrical and engineering students of the Birkenhead Technical School recently visited the works of the Liverpool Electric Cable Co., Ltd., Bootle, and were accompanied by Mr. H. E. Dance, B.Eng.(Hons.), A.M.I.E.E., and Mr. B. L. Myer, A.M.I.E.E., lecturers. After an interesting tour of inspection, during which the various processes were explained by members of the company's staff, the visitors were entertained to tea.

For Sale.

By direction of the Birmingham Battery & Metal Co., Ltd., which is now purchasing electrical energy from the Birmingham Corporation, Messrs. Edwards, Son & Bigwood, will sell by auction, on June 20th, at High Street, Selly Oak, gas producer and electric generating plant, &c. Dartford Electricity Department has for disposal one 150-kW steam generating set. (See our advertisement pages to-day.)

Deed of Assignment.

MESSRS. J. H. HOLMES & CO., electrical engineers, and W. H. HOLMES & SONS, paint and colour manufacturers, Newcastle-on-Tyne.—A meeting of the creditors was held in Newcastle-on-Tyne on May 23rd, Mr. James Arnott, of Messrs. Arnott & Co., presiding. Mr. J. Miller, one of the trustees under the deed of assignment, said that the partners in the firms were Messrs. Alfred Holmes, John Henry Holmes, Ellwood Holmes, and Stephen Holmes. Twelve months ago they consulted him with regard to their financial affairs, and made the necessary arrangements for him and his co-trustee, Mr. Jeffrey Taylor, to carry on the concerns pending better times or other developments. The electrical business was founded in 1848, and the paint and colour business in 1883. Prior to 1914 they were ordinarily prosperous, and during the war did exceedingly well. From 1920 onwards, however, trading results in both concerns had been very bad indeed, particularly with regard to the manufacture of small motors, though in the switchboard section business had been fairly profitable. At September, 1921, the capital of the businesses was £231,942, subsequently reduced to £227,000. In the six and a-half years ended in March, 1928, the losses totalled £106,663, an average of over £16,000 per annum, and in that period the drawings of the four partners amounted to £52,047. After the valuation of assets they found a deficiency of £25,000, partly-secured creditors representing £12,971. The electrical business was now done almost entirely in London and the South, the local trade having been practically lost. The trustees incurred considerable risks in carrying on, but they did so only to complete contracts in hand, and more than half the staff had left. It would be for that meeting to decide whether they should carry on for another month or two to see if the businesses could be sold as going concerns or whether by the appointment of a committee of inspection the concerns could be reorganised and placed on a sound commercial basis. The partners had no offer to make. Miss Florence Holmes was a creditor for £10,000 or £11,000, Mr. Alfred Holmes for £23,349, Mr. John Henry Holmes for £40,891, Mr. Ellwood Holmes for £4,670, and Mr. Stephen Holmes had a personal deficiency of £1,965. Their shares of profit had been, respectively, 30 per cent., 30 per cent., 30 per cent., and 10 per cent The losses on the electrical business for the last 6¼ years aggregated £126,070; and those on the paint business £14,213, a combined total of £140,283. Included in that loss was £33,620 interest on partners' capital, which, deducted, left a trading loss of £106,663. All the creditors with whom the trustees came into contact expressed deep sympathy with the partners, and hoped that means would be devised for reorganising the concerns. A creditor drew attention to the fact that the firm's note paper specified Mr. Oliver Holmes as a director, but no statement had been made regarding him. Mr. Miller replied that he could find no trace of Mr. Oliver Holmes having been a partner. He had made drawings, but was regarded as an employé of the firm. Mr. F. W. Varney, manager of the electrical branch of the firm in London, declared that it would be nothing short of a disaster if the business was closed down. In the London area they enjoyed a reputation and connection second to none, and possessed the confidence of all their customers. Within the past few weeks he had booked orders to the value of £10,000, and work worth an additional £15,000 was waiting for them if he had the sanction to sign contracts. The outlook was particularly bright. In the past ten years the turnover at the London branch had averaged £43,996, and the sales for the first three months of 1928 represented £14,419. If they reorganised the concern he was confident that prosperity could be regained. Mr. Downey, who recently took charge of the firm's electrical works, said he had prepared a scheme of reorganisation by means of which at least 20 per cent. could be saved on over head charges. After a long discussion it was unanimously decided to confirm the appointment of the trustees, and a committee of eight creditors was chosen to explore all avenues for reorganising and carrying on the concerns, and to report to an adjourned meeting of creditors at any early date. Those elected to the committee were: Messrs. Saunders (London Electric Wire Co. & Smiths, Ltd.), Baxter (Igranic Electric Co., Ltd.), Graham, Humphries (Brookhirst Switchgear, Ltd.), Davidson (Imperial Chemical Industries, Ltd.), Brown (Cooksons), Robinson, and Arnott (J. Arnott & Sons, Ltd.), and a representative of Lloyd's Bank, Ltd. The creditors include:—

	£
Lloyd's Bank	31,108
Imperial Chemical Industries, Ltd.	1,457
London Elec. Wire Co. & Smiths, Ltd. ...	1,344
Cooksons	1,088
Arnott, J., & Sons, Ltd.	819
Igranic Electric Co., Ltd.	582
Brookhirst Switchgear, Ltd.	303
Robinson, H.	185

New Catalogues and Lists.

THE AUTOMATIC TELEPHONE MFG. CO., LTD., Strowger Works, Liverpool.—An illustrated pamphlet dealing with the "Beasley-Gamewell" closed-circuit fire-alarm system.

MESSRS. J. A. CRABTREE & CO., LTD., Lincoln Works, Walsall.—"The Crabtree," No. 4, containing several short interesting articles upon tumbler switches and other matters. Also Leaflet No. 1028, illustrating and describing the "Lincoln" switch-fuse.

MESSRS. WALTER MCGEE & SON, LTD., Albion Works, Paisley.—List No. 1110, dealing with "Emcol" totally-enclosed squirrel-cage induction motors.

MESSRS. CROMPTON-PARKINSON, LTD., Chelmsford.—Specification TR.1040, detailing the construction of the company's 33,000-V core type transformers. Illustrated.

LIGHTING TRADES, LTD. (incorporating J. & W. B. SMITH, LTD.), Oriel House, Farringdon Road, E.C.4.—A comprehensive illustrated catalogue (214 pp.) of lighting fittings, including all kinds of domestic equipment, commercial and industrial patterns, ships' fittings, signs, &c. There is also a section devoted to accessories, and several pages are occupied by a special code.

SANTON, LTD., Newport, Mon.—A pamphlet describing the "Santon" circulating immersion heater, with illustrations and prices, and a leaflet advertising the company's electric tank belt.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—List No. P.237, containing a list of customers for the company's cables for working pressures of from 20,000 to 25,000 V.

THE LONDON RADIO MANUFACTURING CO., LTD., Station Road, Merton Abbey, S.W.19.—Illustrated and priced leaflets advertising the "Orphean" cone loud-speaker and a separate "drive unit."

MESSRS. GENT & CO., LTD., Faraday Works, Leicester.—Book 1, Section 2a, an illustrated catalogue of iron-cased bells, indicators, relays, &c., for electrical operation in mines, industry and railway systems.

THE ELECTRO-MECHANICAL BRAKE CO., LTD., Moor Street, West Bromwich.—Pamphlet No. 61, containing an illustrated description of the company's air-break pillar-type starters for a.c. motors.

THE BRITISH ALUMINIUM CO., LTD., Adelaide House, King William Street, E.C.4.—Booklet No. 306, dealing with the properties and uses of aluminium paint.

MESSRS. MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow.—Leaflet No. 161/1, illustrating and describing the company's flameproof oil-break switchgear for use in fiery mines.

MESSRS. GEORGE BRAY & CO., LTD., Leeds.—Catalogue C1, describing, with illustrations, "Chromalox" electric heating units for various applications. Priced.

MESSRS. J. CHURLY CANN, LTD., 16-20, Farringdon Avenue, E.C.4.—A wholesale price list of brass and nickel-plated terminals, screws and various small radio parts. Also a leaflet advertising the "Wallnut" lead-in switch.

MESSRS. J. H. TUCKER & CO., LTD., King's Road, Tyseley, Birmingham.—A folder drawing attention to the positive action of Tucker tumbler switches.

MESSRS. JOHN MOORES & CO., Ravald Street Works, Salford. A priced pamphlet advertising "Megohmior" rubber bushes.

ALLOY WELDING PROCESSES, LTD., 14-16, Church Street, N.1.—A booklet illustrating a number of welding sets constructed by the company for various authorities.

THE CONSOLIDATED PNEUMATIC TOOL CO., LTD., 170, Piccadilly, W.1.—An illustrated pamphlet (E.L.7) dealing with the "Little Giant" electrically-operated flameproof coal and stone drill.

MESSRS. KNOWLES & SON, 87, Wardour Street, Piccadilly, W.1.—An illustrated and priced catalogue of electric soldering irons.

Trade Announcements.

The registered and head office of the ISLE OF WIGHT ELECTRIC LIGHT & POWER CO., LTD., is now at 14, Union Street, Ryde, I.o.W.

Mr. A. N. EYRE, who for the past sixteen years has been connected with Messrs. Siemens's Birmingham branch, has joined Mr. A. H. Newey, and the title of the firm of W. H. Price & Newey, Ltd., has been altered to NEWEY & EYRE, LTD., wholesale electrical factors, 57, St. Paul's Square, Birmingham.

Mr. C. H. H. KENWORTHY, electrical engineer, has opened new showroom premises at 86 to 94, High Street, Herne Bay.

Polish Foreign Electrical Trade.

During March last the imports into Poland of "Apparatus, conductors, and other electrotechnical materials" were valued at 11,178,000 zloty (about £257,000), and exports of this class of goods had a value of 161,000 zloty (£37,000).

Dissolutions of Partnership.

ELSTON BROS. & TAPSCOTT, electrical and mechanical engineers, 62a, Christchurch Road, Southend-on-Sea.—Mr. R. Elston, Mr. E. P. Elston, and Mr. L. V. Tapscott have dissolved partnership. Debts will be attended to by Messrs. R. and E. P. Elston, who will continue the business.

LUND BROS. & CO. and the ELECTRIC SIGN EQUIPMENT CO., Blackfriars, London.—Messrs. R. J. Triggs and C. A. N. Roberts have dissolved partnership. Debts will be attended to by Mr. Roberts. (See our advertisement pages to-day.)

Further Fan Propaganda.

In addition to those companies mentioned in our last issue, the following have sent us publicity matter for the promotion of sales of electric fans:—Messrs. VERITYS, LTD., whose catalogue contains illustrations and prices of many examples of their "Orbit" oscillating fans, and Messrs. DRAKE & GORHAM WHOLESALE, LTD., whose Pamphlet No. 454 presents revolving ceiling fans, oscillating models, &c.

New French Companies.

A number of the electricity undertakings in the Lyons district have recently joined together in forming a company with a capital of 300,000 francs and the title La Société pour l'Etude des Interconnexions Electriques de la Région Lyonnaise. The purpose of the new organisation is to draw up a scheme for the linking up of the various electricity installations in the district. The Société des Transports d'Energie de l'Ouest has been formed in Paris (54, Rue de la Boetie), with a capital of three million francs, with the object of establishing power transmission lines in Western France.

Unemployment.

There was an increase of 14,580 in the number of registered unemployed during the week ended May 14th. At that date the total was 1,118,400, as compared with 1,103,820 on May 7th and 1,007,020 on May 16th, 1927.

The Marking of Imported Cables and Lamps.

On May 23rd a draft Order-in-Council under the Merchandise Marks Act, 1926, was laid before both Houses of Parliament, providing for the marking of several classes of goods with the name of the country of origin upon importation. In each case the recommendations of the Board of Trade Standing Committee have been closely followed. Included in the Order are insulated cables and wires, and electric incandescent lamps, and although we dealt with the Committee's reports of the inquiries at the time they were issued, for the convenience of those concerned the provisions of the Order are reproduced below from the *Board of Trade Journal*:—

Part II (*Insulated Electric Wires and Cables*).

7. It shall not be lawful to import into the United Kingdom any insulated electric cable or wire nor to sell or expose for sale in the United Kingdom any imported insulated electric cable or wire unless it bears an indication of origin.

8. The indication of origin shall be marked as follows:—

(*a*) When the cable or wire is imported, sold or exposed for sale on drums, reels, bobbins or spools the indication shall be indelibly branded, incised, or impressed by stamping on both ends of the drum, reel, bobbin or spool;

(*b*) When the cable or wire is imported in a coil or is sold or exposed for sale in a coil as imported, the indication shall be indelibly stamped or printed on a label attached to the coil by a band the ends of which are brought together in a leaden seal;

(*c*) When the cable or wire is sold or exposed for sale in a coil after being coiled or recoiled in the United Kingdom, the indication shall be indelibly stamped or printed on a label securely attached to the coil;

(*d*) Where any cable or wire is sold from a coil, the label bearing the indication of origin shall remain attached to the coil from which it is sold;

(*e*) Where any cable or wire is imported or sold or exposed for sale in a covering, carton or other container, the container shall also bear the indication of origin.

9. Goods to which this Part of this Order applies shall bear the indication of origin therein provided on exposure for sale wholesale, whether or not the person so exposing the goods is a wholesale dealer.

10. Nothing in this Order shall apply to any cable or wire if at the time of importation it forms a part of or is accessory to another article with which it is imported.

11. This part of this Order shall come into force at the expiration of three months from the date of this Order.

PART III.—(*Electric Incandescent Lamps*).

12. It shall not be lawful to import into the United Kingdom any electric incandescent lamp nor to sell or expose for sale in the United Kingdom any imported electric incandescent lamp unless it bears an indication of origin.

13. The indication of origin shall be indelibly marked on the bulb and also on any carton, wrapper or other container in which the lamp is imported, sold or exposed for sale;

Provided that in the case of pea-bulbs, surgical instrument lamps and any other electric incandescent lamps the bulb of which is 15 millimetres or less in diameter it shall be sufficient if the indication of origin is borne on the carton or other container in which they are imported sold or exposed for sale or from which they are sold.

14. Goods to which this part of this Order applies shall bear the indication of origin therein provided on exposure for sale wholesale, whether or not the person so exposing the goods is a wholesale dealer.

15. This Order shall not apply to (*a*) wireless valves and mercury vapour arc lamps, or (*b*) lamps which at the time of importation are parts of or accessory to other articles with which they are imported.

16. This part of this Order shall come into force at the expiration of six months after the date of this Order.

Book Notices.

"An Introduction to Electrical Drawing," Part I, by E. H. H. Gibbins. Pp. 63; illustrated. London: Blackie and Son, Ltd. Price 3s.

Quarterly *Bulletin* of the British Cast Iron Research Association. No. 20, April, 1928.

"An Investigation of a Rotating Radio Beacon" (Special Report No. 6. Department of Scientific and Industrial Research). Pp. 45; illustrated. London: H.M. Stationery Office. Price 2s. 3d. net.

"Studies in Molecular Force," by H. Chatley. Pp. xi+118. London: Chas. Griffin & Co., Ltd. Price 7s. 6d. net.

"Drafting for Engineers," by C. L. Svensen. Pp. xi+363 and appendix vii, figs. 583. London: Blackie & Son, Ltd. Price 12s. net.

"Official Handbook, 1928." Pp. xxiii+40; illustrated. London: The Radio Association. Price 1s. 6d. net. Edited by C. M. R. Balbi, A.M.I.E.E., this helpful little book contains several articles by well-known writers.

"Telephone and Power Transmission." By R. Bradfield and W. J. John. Pp. xi+238; figs. 113. London: Chapman and Hall, Ltd. Price 21s. net.

"Transmission Line Engineering." By W. W. Lewis. Pp. vii+361; figs. 200. Price 20s. "Induction Motor Practice." By A. M. Dudley. Pp. xi+236; illustrated. Price 12s. 6d. London: McGraw-Hill Publishing Co., Ltd.

"The 1928 Annual and Log Book of the Incorporated Radio Society of Great Britain," price 4s., contains a list of the principal amateurs in various parts of the world, besides useful technical articles and data.

We have again received from the Lancashire United Transport & Power Co., Ltd., its annual booklet "Touring by Motor Coach" (price 6d.), giving illustrated particulars of tours in the Lake District, North Wales, and several counties.

"Quarterly Trade Survey," June (47 pp., including 20 sets of curves). London: British Electrical and Allied Manufacturers' Association. Price 5s. net.

Recent Contracts.

A contract has recently been placed by the Government of India with the GENERAL ELECTRIC CO. (INDIA), LTD., against international competition, for two years' supply of d.c. and a.c. ceiling fans. The total number required, it is anticipated, will run into many thousands. The tender was accepted after the most careful consideration, and tests as to air displacement and velocities of each of the many types ordered, and the ability of the fans to operate continuously in a tropical heat. The order supplements a number of important home and Dominion contracts, and work will be found for a large number of additional operatives at the fan works of the company at Witton, Birmingham.

Messrs. BURNE-JONES & CO., LTD., have received an order for 100 radio receiving sets for which tenders were invited by the Derbyshire Association for the Blind.

B.E.D.A. and the I.M.E.A. Convention.

We learn that the British Electrical Development Association is arranging to exhibit demonstration poster stations during the I.M.E.A. Convention at Bath, outside the Assembly Rooms in Alfred Street, and also outside the Grand Pump Room. The exhibition of these poster stations is the commencement of an attempt to secure a considerable increase in the amount of outdoor publicity employed by electricity supply undertakings. The posters and messages in the poster stations will be changed daily during the course of the Convention.

Automatic Electric Cooking.

To substantiate its claim that electric cooking equipment can be left to look after itself, the Electric League of Milwaukee recently gave a novel demonstration. According to *Electrical Merchandising*, upon a platform entirely surrounded by glass panels were placed an electric range, a refrigerator, a toaster, and a coffee percolator. A battery of five electric "start and stop" switches was connected in series with the range elements, and similar switches were placed in the toaster and percolator circuits. At four p.m. upon the appointed day a cook prepared a complete dinner and set the timing clocks, and the enclosure was then locked. Invitations to dinner at 8.30 had been issued, and promptly at that hour the enclosure was unlocked and the complete meal was found to be ready. The "stunt" gained the Milwaukee League nearly 400 inches of notices in the local Press.

Brazilian Electrical Imports.

During 1927 the bulk of the electrical apparatus imported into Pará, Brazil, again came from Great Britain. This country's share amounted to 151 metric tons, as compared with 345 tons in 1926. The amount provided by Germany fell from 19 to 10 tons, while the share of the United States increased from 10 to 13 tons.

The Government's Rating Relief Scheme.

Last week the text was issued of the Government's Rating and Valuation (Apportionment) Bill. This measure is designed to carry out the proposals which the Chancellor of the Exchequer outlined in his Budget speech. It is provided that as from October 1st, 1929, valuation lists shall distinguish from other property agricultural, industrial and freight-transport hereditaments, and each of these classes is defined. An industrial hereditament is defined as a mine, or, subject to certain exceptions, as a factory or workshop. The exceptions include hereditaments the primary purpose of which is use as a dwelling house, retail shop, for storage, or wholesale distribution; for the purposes of a public supply undertaking; or as a garage. It is also provided that a property shall be considered an industrial hereditament if the net annual value of the part used for non-industrial purposes does not exceed 10 per cent. of the net annual value of the part used for industrial purposes. Provisions relating to the methods to be adopted by rating authorities are fully set out in the Bill.

Italian Foreign Electrical Trade.

The imports of electrical machinery, apparatus, and other allied goods into Italy during the first two months of this year were valued at £466,100, as compared with £547,300 in the corresponding period of 1927. The exports of similar goods of Italian manufacture during the same period declined from £118,300 to £108,750.

Glasgow and E.D.A.

A letter was recently submited to Glasgow Corporation Sub-Committee on Propaganda (Electricity) from the Secretary of the British Electrical Development Association, intimating that it was proposed to organise an Industrial Electric Heating Exhibition in Glasgow in February, 1929, and asking the Corporation to provide the necessary accommodation and to give free space and free supplies of electrical energy to exhibitors. The Sub-Committee agreed to recommend that no action be taken in the matter.

Local Exhibition.

An exhibition of plant and machinery is being held at Stanley Park, Blackpool, from June 2nd to 9th. Music will be provided by wireless, ten loud speakers being placed in different parts of the exhibition. This is being done by the Electricity Department, in conjunction with the promoters.

Large French Amalgamation.

It is reported that the leading French electrical manufacturing companies, the Cie. Française Thomson-Houston and the Société Alsacienne de Constructions Mécaniques have amalgamated. The companies' undertakings will be acquired by a new concern which is being formed with a capital of 400 million francs divided equally between the two concerns. Certain branches of each will remain outside the combination.

Proposed American Merger.

According to the newspapers, negotiations are in progress for a merger of the United Light and Power Company with the American Light and Traction Company, involving properties worth together £75,000,000. The Koppers Company, of Pittsburg, in which the Mellon family is largely interested, is understood to be behind the negotiations.—*Reuter* (New York).

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.		Price May 29th.	Fortnight's inc. or dec.
a	Acid, Oxalic	per lb.	5¾d.	...
a	Ammoniac, Sal	per ton.	£60	...
a	Ammonia, Muriate (large crystal)	,,	£52	...
a	Bisulphide of Carbon	,,	...	...
a	Borax	,,	£25	...
a	Copper Sulphate	,,	£25 10s.	...
a	Potash, Chlorate	per lb.	3½d. to 4d.	...
a	,, Perchlorate	,,	5¾d.	...
a	Shellac	per cwt.	£13 10s.	...
a	Sulphur, Commercial	,,	£11	...
a	,, Roll	,,	£11	...
a	Soda, Chlorate	per lb.	3d.	...
a	,, Crystals	per ton.	£5 to £5 5s.	...
a	Sodium Bichromate, casks ...	per lb.	3¼d.	...
	METALS, &c.			
b	Aluminium, Ingots	per ton.	£105 to £112	...
b	,, Wire	per lb.	1/8 to 1/9	...
b	,, Sheet	,,	1/8 to 2/9	...
p	Babbitts Metal and Anti-friction Metal—			
	Grade I	per ton net.	£210	...
	Grade II	,, ,,	£145	...
	Grade III	,, ,,	£77	...
c	Brass (rolled metal 2" to 12" basis)	per lb.	9¾d.	...
c	,, Tubes (solid drawn)	,,	11¾d. to 1/-	...
c	,, Wire, basis	,,	9¼d.	...
c	Copper Tubes (solid drawn) ...	,,	1/1	...
c	,, Bars (best selected) ...	per ton.	£92	...
c	,, Sheet	,,	£94	...
c	,, Rod	,,	£92	...
d	,, (Electrolytic) Bars	,,	£88	15/- inc.
d	,, ,, Sheets ...	,,	£143 10s.	...
d	,, ,, Wire Rods	,,	£78	15/- inc.
d	,, ,, H.C. Wire	per lb.	9½d.	½d. inc.
f	Ebonite Rod	,,	2/3 to 2/6	...
f	,, Sheet	,,	2/3 to 2/6	...
n	German Silver Wire	,,	2/2	...
h	Gutta-percha, fine	,,	6/8	...
h	India rubber, Para fine	,,	10½d.	...
l	Iron Pig (Cleveland No. 3.) ...	per ton.	65/-	...
l	,, Wire, galv. No. 8, P.O. qual.	,,	£21	...
g	Lead, English pig	,,	£22 10s.	15/- inc.
g	Mercury	per bot.	£22 7s. 6d. to £22 10s.	...
e	Mica (in original cases) small ...	per lb.	3d. to 8/-	...
e	,, ,, medium	,,	4/- to 8/-	...
e	,, ,, large ...	,,	10/- to 20/- & up	...
p	Phosphor Bronze, plane castings	,,	1/8½	...
p	,, ,, drawn bars & rods	,,	1/8	...
p	,, ,, rolled strip & sheet	,,	1/2¾	...
p	,, ,, wire...	,,	1/8½	...
e	Platinum	per oz.	£17 15s.	...
d	Silicium Bronze Wire	per lb.	10½d.	...
r	Steel, Magnet, in bars	,,	7¼d.	...
m	Tin, Block (English)	per ton.	£227 15s. to £228 15s.	£5 dec.
n	,, Wire, Nos. 1 to 16	per lb.	3/10	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
m P. Ormiston & Sons.
n Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Tramway Plant for Spain.

The British Vice-Consul at Granada reports that a company has been formed for putting down an electric tramway from Guadix to Alcudia. He understands that the company requires a 150-h.p. Diesel engine and a 100-kW generator (550 V), and the necessary rolling stock. The name of the company can be obtained by British firms on application to the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1. (Reference A.X. 6331.)

The A.E.U. and the Mond Conference.

At the Southport congress of the Amalgamated Engineering Union a resolution was passed expressing the Union's disapproval of the action of the General Council of the Trades Union Conference in entering into conference with a group of employers on the subject of industrial relations and reorganisation. Another resolution, declaring the opposition of the Union to the objects of the Industrial Peace Conference, was not carried, but the delegates passed a further resolution to the effect that the Union considered that engineering councils of employers and workers were inimical to the best interests of the trade union movement.

Jugo-Slav Telephone System.

Tenders were recently invited for the extension of the telephone network from Belgrade to Nisch, Subotica and Marburg, as well as for the establishment of three automatic exchanges. The Standard Electric Company, in connection wtih the Felten & Guilleaume Company of Budapest, is reported to have competed with a German syndicate—Siemens and Halske and the Felten & Guilleaume Company of Cologne—for the cable orders. In the case of the exchanges, offers were received from the Standard Electric Company, the Siemens & Halske Co., and the Automatische Fernsprechanlagen. A decision on the tenders is to take place in a few weeks.

Lighting and Power Notes.

Aberdeen. — INAUGURATION OF EXTENSIONS. — The new 16,700-h.p. turbo alternator recently installed at the Corporation power station was formally set in motion by Lord Provost Lewis on May 24th. The Lord Provost said that the installation of the new generating plant practically completed the Corporation's last scheme of expansion which had cost it approximately £700,000. Mr. J. A. Bell, city electrical engineer, said that the electricity sold per head of population was 151 kWh in 1925, 175 kWh last year, and he thought it would be over 190 kWh this year.

Chesterfield.—YEAR'S WORKING.—We have received from Mr. D. H. Davies, borough electrical engineer, a copy of his report, together with the statement of accounts for the year ended March 31st last. The total revenue amounted to £66,276, as compared with £58,569 in the preceding year. Working expenses and capital charges totalled £54,504, as against £56,047, and there was a net surplus of £11,772, as compared with £2,522 in 1926-27. The electricity generated amounted to 12,596,630 kWh, and the amount purchased in bulk was 608,994 kWh. The sales of electrical energy increased from 8,199,676 to 10,700,751 kWh, an increase of 30 per cent., which constitutes a record for the undertaking. The maximum supply demanded rose from 5,078 to 6,841 kW. The operating cost and the average price obtained per kWh were the lowest on record, being 0.67d. and 1.36d. respectively. Additions to the cable network during the year amounted to 28 miles and brought the total to 162 miles. In spite of the low price of domestic coal, 1,060,000 kWh was sold for heating and cooking during the year, being an increase of 28.6 per cent. Mr. Davies reports that applications for supply are still being dealt with at the rate of about 40 per week, and application is to be made for sanction to a further £25,000 for the assisted wiring scheme, £17,000 having already been expended for this purpose during the past two or three years. A further £15,000 is also to be applied for for additional meters, and £1,500 for transformer kiosks and e.h.p. switchgear. In order to cope with the increasing demand of consumers, a supplementary supply will be taken next winter from the Derbyshire and Nottinghamshire Electric Power Company, and contracts have been let for the necessary equipment to the value of £16,250.

Continental.—BELGIUM.—The Société des Charbonnages de Mariemont-Bascoup has decided to install a third turbo-generator at the power station in connection with its collieries, which will bring the capacity of the plant up to 40 millio. kWh per year. A new battery of boilers adapted for pulverised fuel firing is also to be installed.

Following on the recommendations of the Government Public Works Commission, the Société Intercommunale Belge d'Electricité, in conjunction with the Société d'Electricité de l'Escaut, is at present engaged on the construction at Schelle on the banks of the River Scheldt of what will be the largest

power station in Belgium. Designed for an ultimate capacity of 500,000 kW, the new station will at first be equipped with several sets of 30,000 kW, the second programme providing for the addition of a number of 50,000-kW sets. It is expected that the first section of the plant will be ready for operation early in 1930, when the station will be linked up by a h.p. transmission line between Antwerp on the one hand and Charleroi on the other. At the same time the capacity of the company's power plant at Bressoux is being increased by a 30,000-kW turbo-generator.

ITALY.—A new hydro-electric power station utilising the water of a tributary of the River Isarco has recently been completed and put in operation at Vizze, near Vipiteno. The plant installed has a capacity of 42,000 kVA, and is expected to be able to supply 20 million kWh per year.

GERMANY.—A new joint undertaking under the title of the German Electricity Economy (Industry) Company is being formed by the Reich, Prussia and Bavaria, as represented by the Reich Electro Works Company, the Prussian Electricity Company, and the Bavaria Works respectively. Each authority will participate to the extent of one third in the capital, which has been fixed at the nominal amount of 1,000,000 marks. The main object of the new company is to establish a 220,000-V line from Hamburg to the Tyrol. The company also intends to promote co-operation between the various electricity supply districts and establish an organisation for the purpose of eliminating the frequent opposition and parallel working of interests, and at the same time promote technical and economic simplification and rationalisation of the electricity supply industry.

POLAND.—The report recently issued of the Société des Exploitations Electriques de Lodz et Extensions for last year shows that the output of the power station at Lodz amounted to 78 million kWh, an increase of 58 per cent. over 1926. Already this year, the demand has shown a further 50 per cent. advance, to meet which it has been decided to install a new 20,000-kW turbo-generator to be completed in time for the 1929-30 winter season.

Dumfries.—CHANGE-OVER.—The Town Council, at a special meeting, has adopted a recommendation of the Electricity Committee that it be remitted to the engineer to change the system of electricity supply from d.c. to a.c. as required.

Dundee.—ELECTRICITY SUPPLY.—The Corporation Electricity Committee has authorised extensive repairs to the electrical plant. Regarding an application for borrowing powers in order to complete the scheme of extensions commenced in 1924 it was explained that during the past year there had been an increase in the consumption of electricity of about 20 per cent. The work authorised will cost £41,500.

Glasgow.—PROGRESS DURING APRIL.—Under the Corporation Electricity Department scheme for the wiring of domestic premises, 392 houses were wired in April, making the total to date 7,768, while applications for the hire of appliances numbered 182, making a total of 19,384.

Japan.—ELECTRICAL DEVELOPMENT.—The South Manchurian Electric Co., Ltd., has decided to extend its Amano-gawa power station at a cost of 1,000,000 yen. The capacity of the station is to be increased from 10,000 kW to 22,500 kW.

Lincolnshire.—INQUIRY.—It is expected that the inquiry by the Electricity Commissioners into the proposed electricity scheme for Lincolnshire will be held during June.

Llandudno.—ELECTRICITY EXTENSIONS.—At a recent meeting of the Urban District Council Electricity Committee a letter was read from the Electricity Commissioners with reference to the application for sanction to borrow £19,500 in connection with the electricity undertaking, and forwarding formal sanction to borrow £14,613 on account of the sum applied for. The Commissioners stated that consideration of loan sanction in respect of the sum of £2,487 for the new motor convertor, which it is anticipated will not be required until about two years time, has been deferred until the Council requires to proceed with the installation of such plant. The clerk stated that since the date of the application the engineer had reported that the Easter load had conclusively proved that it will be necessary to take immediate steps to install the additional motor convertor, and he had forwarded a copy of the report of the electrical engineer on the subject to the Commissioners.

London.—BERMONDSEY.—The Borough Council Electricity Committee has received a report from the borough electrical engineer, in which he states that the capacity of the station during the winter of 1929-30, as at present proposed, will be 8,000 kW. He estimates that the load on the station during that winter will probably reach 7,500 kW, and this will necessitate the running of the whole of the plant. There will, therefore, be no stand-by plant available in case of breakdown. In his opinion the Council should install a further 2,000 kW before that time, and he considers that sanction should be obtained at once for an additional machine of this size. The estimated cost of one 2,000-kW rotary convertor, with the necessary e.h.p. switchgear, d.c. panel and all connections, will be £8,240. The Committee has authorised the engineer to obtain tenders for the additional plant specified.

POPLAR.—The Borough Council Electricity Committee has considered a report from the borough electrical engineer as to the effect of the development of the load upon the main stations and its relationship to the distributing facilities throughout the borough. The engineer reported that it was now necessary to advocate considerable extensions to the distribution system in order to maintain satisfactory equable voltages in all sections of the area. The Committee has agreed to the following preliminary estimates of the cost of placing the undertaking in a position to do this:—Bow sub-station, including land, buildings, machinery and switchgear, £22,605; h.p. mains in connection therewith, £1,870; l.p. mains, £4,721; extension to High Street sub-station, £5,407; voltage regulation at sub-station, £400; Kerbey Street network, £1,164; cables from North sub-station, £1,697; extension to North sub-station and cable ducts, £525; diversion of cables at Violet Road Bridge, £698; minor extensions to network, £10,000.

Mansfield.—ELECTRICITY SUPPLY.—Continued interruptions in the bulk supply of electricity from the Derbyshire and Nottinghamshire Electric Power Co.'s generating station has resulted in a recommendation by the Corporation Electricity Committee that a report and estimate be prepared of the additional cost of bringing into commission again the local generating plant, which was superseded when the bulk supply was adopted, so that an additional supply can be assured.

Perth.—STREET LIGHTING.—The Corporation Housing Committee on May 22nd rescinded a previous resolution to adopt gas lighting for Crieff Road housing scheme and agreed to the laying of a cable for electric lighting at a cost of £1,800.

Plymouth.—YEAR'S WORKING.—It was reported at a meeting of the Corporation Electricity Committee on May 22nd, that the budget estimate of the profits of the undertaking had been largely exceeded. The gross profit for the year ending March 31st last amounted to £91,493, and after payment of capital charges there was a net surplus of £32,980, as compared with the budget estimate of £8,744. Of the surplus £5,000 is to be applied to working capital, and the remaining £27,980 placed to reserve.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

ST. PANCRAS.—Lighting: A reduction of ½d. per kWh. Public lighting: A reduction of ¼d. per kWh. Heating, cooking, and hot-water supplies: From 1d. to ½d. per kWh. One-meter system: The "unit" charge from ¾d. to ½d. It is proposed to introduce the kW demand system as an alternative to the flat rate for lighting to consumers who use electricity for lighting during the day-time as well as night, the kW charge to vary from £16 per annum per kW for the first 2½ kW to £10 10s. per kW for over 100 kW, with an additional charge of ½d. per kWh for electricity consumed.

WINCHESTER.—Cooking and heating: Reduced to 1d. per kWh.

HECKMONDWIKE.—Power: First 50 kWh per h.p. of demand per quarter, 3½d. per kWh; all energy in excess, 1d per kWh. Crane supplies, if separately metered, 3½d. per kWh.

LONDON.—*St. James' and Pall Mall Electric Light Co., Ltd.*—Lighting: First 4,000 kWh per annum, from 4½d. to 4d. per kWh; all energy in excess of this amount, from 4d. to 3d. per kWh. Power: The fixed charge of 7s. 6d. per rated h.p. per quarter withdrawn, and the "unit" charge to remain at 1d. per kWh. New charges to come into operation as from midsummer are: Advertising lighting during certain hours on week-days and throughout Sundays, 2d. per kWh. Water heating at off-peak periods, ½d. per kWh.

CALNE.—Electricity for all purposes: A reduction of ½d. per kWh.

LIMERICK.—Lighting: First 1,000 kWh, 8d. per kWh; over 1,000 kWh, 7d.

South Africa.—JOHANNESBURG.—Arrangements are being made for the installation of a fourth 20,000-kW generating set at the Witbank power station. This will raise the total capacity of the station to 80,000 kW, which it is hoped to have in full operation early in 1929. The station will then be the largest in South Africa. Still further additions to Witbank are contemplated in the future by the inclusion of a fifth set to make the full capacity 100,000 kW.

STELLENBOSCH (CAPE PROVINCE).—The Town Council has resolved to obtain electricity from the Electricity Supply Commission, Cape Town, in lieu of the supply at present generated at Stellenbosch. The supply is to be taken from the 33,000-V overhead lines at two different places—one being from the Somerset West line about Eerste River, and the other from the Faarl Line near Mulders Vlei. It is also understood that a duplicate line will shortly be in service from Bellville to the Commission's power station at Salt River, which in turn is linking up with the Cape Town Corporation station at Dock Road.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by West of England Electricity, Ltd., authorising it to supply electricity in the borough of Woodstock, the urban district of Bicester, and the rural districts of Woodstock, Bicester, and Chipping Norton; and the Power Development Co., Ltd., to supply electricity in parts of the rural districts of Salisbury and Fordingbridge.

The Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the West Lancashire Rural District Council to supply electricity in the parish of Aughton.

Stoke-on-Trent.—CINEMA SUPPLY.—At a recent meeting of the Corporation Electricity Committee correspondence with the Provincial Cinematograph Theatres, Ltd., respecting the supply to the new Regent Cinema Theatre was submitted. It was agreed that the charges for supply, based on a minimum consumption of 100,000 kWh per annum, should be at the rate of 3d. per kWh for lighting, 2d. for motor generator supply, and 1d. for power, and that the mains should be extended from the switching station, Hanley Town Hall, and from the switching station, Piccadilly, at a cost of £750.

ELECTRICITY IN BULK.—The Leek Urban District Council has agreed to the terms offered by the Corporation for a bulk supply of electricity.

CHANGE-OVER.—The engineer has reported upon the change-over of supply from 100 to 50 cycles in the Hanley district, and submitted a scheme for the laying of mains. The Electricity Committee decided that the mains should be laid, and the switchgear required for sub-stations provided, at an estima cost of £1,700, and voted £400 for changing motors, starters and lamps on consumers' premises.

United States.—ELECTRICAL DEVELOPMENT.—*Power* reports that the output of electricity by public utility power plants in the United States in 1927 was 80,205,000,000 kWh, according to the revised figures of the Department of the Interior, recently published by the Geological Survey. The increase in output from 1926 to 1927 was about 9 per cent. The amount produced by water power was 37 per cent. of the total, as against 35½ per cent. in 1926. The net importation of electricity from Canada in 1927 was 1,629,000,000 kWh. The total amount of electricity from public utility sources utilised in the United States was therefore 81,834,000,000 kWh. This is equivalent to 690 kWh *per capita*. The corresponding figure for Canada in 1927 was 1,320 kWh *per capita*, and that for Norway in 1925 was 2,400 kWh *per capita*.

Tramway and Railway Notes.

Canada.—DIESEL-ELECTRIC CARS.—Sir Henry Thornton, president of the Canadian National Railways, announces that the problem presented by the branch lines on which steam trains cannot be profitably run has been solved by the use of Diesel-electric cars. These cars have been in operation on several branches of the system, taking the place of the steam trains, and last year this branch of the service showed substantial profits, as compared with the deficit of previous years. The company has in contemplation the construction of larger units of the same type.

Continental.—BAVARIA.—The work of electrifying the section of the Bavarian railways between Rosenheim and Traunstein has recently been completed, and electric trains are now running between the two towns. It is expected that the section between Traunstein and Salzburg will also be completed within the next few weeks.

Japan.—RAPID TRANSIT RAILWAY.—The Tokyo-Yokohama Rapid Transit Electric Railway Co., Ltd., is to be formed with a capital of 10,000,000 yen. The line will be constructed between Gotanda in Osaki-Machi, near Shinaga, Tokyo, and Ura-Takashimacho, Yokohama, a distance of 14 miles.

ELECTRIC RAILWAY EXTENSION.—The Joshin Electric Co., Ltd., has applied for permission to extend its railway from Yoshü station to Yorü-machi, through Fujioka-machi, a distance of 14 miles. The cost of the scheme is estimated at 1,700,000 yen.

Leeds.—YEAR'S WORKING.—At a meeting of the City Tramways Committee on May 21st, a draft statement of the accounts of the combined tramway, railless-car, and motor-omnibus services was adopted, subject to audit. The total revenue amounted to £1,003,547, an increase of £79,228, as compared with the previous year, and after deducting all charges there was a net surplus of £66,647, of which £60,165 is to be transferred to the borough fund, and the remainder placed to reserve. The amount spent on permanent way renewals during the year was £40,435, and contributions to capital expenditure totalled £53,508. The number of passengers carried showed an increase of 13,417,802 over the previous year's figure of 147,407,849, but there was a slight decrease in the average revenue per car mile from 17.523d. to 17.417d.

Liverpool.—PROPOSED TRAMWAY EXTENSION.—The City Council will consider at its June meeting a proposal of the Tramways Committee to apply for an Order authorising the construction of a double tramway track from Warbreck Moor terminus along the Liverpool and Ormskirk main road, a distance of half-a-mile.

London. — "UNDERGROUND" IMPROVEMENTS. — Piccadilly Circus underground station is to have eleven escalators—the largest number at any one station in the world. Tooting Broadway Station, which has had two since it was opened in 1926, is having a third installed, while escalators are to be installed at Highgate and Camden Town. The Underground Company will have spent £620,000 on escalators when the present scheme is completed. Tooting Broadway, though one of the newest underground stations, has a traffic of over 800,000 passengers a month.

United States.—RAILWAY ELECTRIFICATION.—Coming electrification in New Jersey by the Delaware, Lackawanna and Western Railroad will, according to a recent announcement, include the Morris and Essex line from Hoboken to Dover, the Passaic and Delaware to Gladstone and the Montclair branch —a total of 76 miles of road or 173 miles of track, at an expenditure of approximately $14,000,000. The *Electrical World* states that the construction and equipment of the proper power plant and accessories would cost about $4,250,000 and would raise the total cost of this electrification work to the neighbourhood of $18,000,000. Construction work will be started as soon as the Lackawanna engineers can prepare plans, and it is estimated that it will be completed within two years.

Walsall.—ABANDONMENT OF TRAMWAY ROUTE.—The Town Council has approved a proposal to substitute motor-omnibuses for tramcars on the Birmingham Road route.

Telegraph and Telephone Notes.

Dutch East Indies.—TELEGRAPHY AND TELEPHONY.—The recently-issued report of the Dutch East Indies telegraph and telephone authorities for 1926 shows that at the end of that year there were 6,777 miles of overhead telegraph lines, 7,571 miles of submarine cables, and 58 miles of underground and other cables in use in the area, the total of 14,406 miles representing 28,352 miles of wires and cables. As regards the telephone service, the number of exchanges has grown from 292 with 35,647 subscribers in 1923 to 308 and 39,355, respectively, at the end of 1926.

Guernsey.—TELEPHONE SERVICE.—The revenue statement and statistics issued by the State Telephone Department of the island (of which Mr. E. H. Bennett is manager and engineer) show that for the year ended December 31st, 1927, the gross revenue increased by £648 to £18,758, the net profit being £796. The number of lines increased by 189 to 4,054, and junctions by six to 96. Metallic circuit wire overhead decreased by 20 miles to 2,414, while the mileage underground increased by 238 to 4,724. Calls increased by 110,886 to 2,504,007; trunk calls numbered 15,745. Telegrams and letters telephoned to the post office totalled 24,415.

Hull Telephone Service.—NEW EXCHANGES.—The Hull Corporation Telephones Committee opened two new automatic exchanges on May 24th, which have been added to the municipal system at a cost of over £30,000.

India.—TELEPHONE SERVICE.—The annual report of the Indian Post and Telegraph Department for 1926-27 shows that telephony is increasing in popularity. According to *The Times*, the Department is frank about its achievements, for it states that ". . . the trunk service between Bombay and Delhi was at times satisfactory," but between Bombay and Calcutta "good commercial speech . . . was not always reliable." The former loss of Rs. 4,91,275 (£36,825) has been converted into a profit of Rs. 1,34,745 (£10,125).

TELEGRAPH SERVICE.—The report records the passion of Burmese boys for maliciously damaging telegraph insulators, and that of their elders for stealing copper wire. The year's loss on the service was Rs. 12,72,332 (£95,400) while the previous year's was only Rs. 6,93,846 (£52,250).

International Telephony.—ANGLO-SPANISH SERVICE.—Telephone communication between Madrid and London was inaugurated on May 24th, *via* Biarritz, Bordeaux, and Paris. Britain is now linked telephonically with 14 European countries.

Radio Notes.

Battery Eliminators.—LLANDUDNO WARNING.—At a recent meeting of the Urban District Council Electricity Committee the engineer reported upon the connection to domestic mains of d.c. anode-battery eliminators which are not suitable for an alternating-current supply. It was decided to issue a public notice to owners of wireless sets and tradesmen dealing in such apparatus against the installation of such eliminators, stating that the Council will not be responsible after such notice for the cost of alterations rendered necessary by a change of system.

Sweden.—LICENCES.—Statistics of the number of wireless receiving licences valid in Sweden in April show a fresh increase during the month to 360,059, or 59.1 per thousand of the inhabitants of the country.—*Reuter's Trade Service* (Stockholm).

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—July 17th. Postmaster-General's Department. Switchboard cable. (B.X. 4431.)*

Belfast.—June 2nd. Electricity Department. Continuous current switchgear for sub-stations. (May 18th.)

Bexhill.—June 7th. Electricity Department. English-made electric lamps for 12 months. (May 25th.)

Blantyre, Nyasaland.—Town Council. One 120-h.p. cold-starting crude-oil engine, direct coupled to a 120-kVA a.c. generator, with exciter, or, alternatively, one 120-h.p. suction gas engine, direct coupled to an a.c. generator; 500 tons best anthracite beans. (See this issue.)

Conisborough.—June 19th. West Riding Education Committee. Electric lighting installation at the New Middle School. Specifications from Education Department, County Hall, Wakefield.

Douglas.—July 2nd. Corporation. One 1,000-kW steam turbo-alternator, condensing plant, cooling tower and accessories, two 15,000-lb. boilers, with pipework and accessories. (See this issue.)

East Ham.—June 13th. Education Committee. Wiring for electric lighting Napier Road school. Specification (10s.) from the Electrical Engineer, Electricity Department, Nelson Street, East Ham.

Grimsby. — June 14th. Electricity Department. One 10,000-kW turbo-alternator with condensing plant. (May 25th.)

Guiseley (near Leeds).—June 19th. West Riding Education Committee. Electric lighting installation at the new school. Specifications from Education Department, County Hall, Wakefield.

India.—June 5th. India Store Department. 264 miles copper-covered steel wire. (May 25th.)

Irish Free State.—DUBLIN.—June 13th. Electricity Supply Board. Supply and laying of 10,000-V and 380-V underground cables in the County of Dublin. (May 25th.)

Knottingley.—June 4th. U.D.C. Four electrically-driven vertical turbine pumps for sewage works. Specifications, &c., from Mr. C. R. J. Connor, Town Hall.

London.—CENTRAL ELECTRICITY BOARD.—June 29th. 132,000-V overhead transmission lines for the South-East England electricity scheme. (May 18th.)

LONDON COUNTY COUNCIL. June 12th. Electric lift (15 cwt.) for the Weights and Measures Office. (See this issue.)

Manchester.—June 8th. Electricity Committee. One 15,000-kVA transformer, 33,000/6,600-V outdoor type. (May 18th.) Five 125-kVA transformers for various sub-stations.

June 18th. Electrically-operated wagon tipper for Barton station. (May 25th.)

June 7th. Education Committee. Electric lighting installation at the Cheetham Municipal School, Smedley Street. Specification from the Education Offices, Deansgate, Manchester.

Newport (Mon.).—June 4th. Electricity Department. E.h.p. armoured switchgear and reactors and l.p. control gear. (May 18th.)

New Zealand.—WELLINGTON.—July 10th. Public Works Department. 50-kV switchgear and steelwork for Arapuni power scheme. (B.X. 4410.)*

July 17th. Two 12-ton trolley electric locomotives, four 4-ton ditto, seven 4-ton battery locomotives, with spares, two 150-kW motor-generator sets and switchgear, and overhead line equipment. (A. 6317.)*

Skegness.—Urban District Council. Switchboards, transformers, cables, &c., in connection with the bathing pool, piazza, boating lake, &c. (May 25th.)

South Africa.—CAPE TOWN.—June 13th. City Council. Insulated copper wire. (B.X. 4437.)* Electric light poles, cross arms, insulators, street lighting fittings, &c. (B.X. 4441.)*

Tain.—July 4th. Corporation. Underground and overhead mains, street lighting, and meters. (See this issue.)

Uruguay.—MONTEVIDEO.—July 13th. State Electricity Supply Works. Twelve 3-phase, 33,000-V transformers. (B.X. 4461.)*

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Australia.—SYDNEY.—Municipal Council.
H.p. metal-clad outdoor switch units (£6,525).—Standard Waygood, Ltd.
Metal-filament lamps.—Noyes Bros. (£4,627); British General Electric Co., Ltd. (£2,937).

MELBOURNE.—City Council.
D.c. switchgear for sub-stations (£3,996).—Tombs and Howcroft Pty., Ltd.
Totally-enclosed armoured switchgear (£5,462).—A. Reyrolle & Co., Ltd.
Triple-braided cables (£916).—W. T. Henley's Telegraph Works Co., Ltd.
Two 2,500-kW rotary convertors (£9,753).—Siemens (Aust.) Pty., Ltd.

NEWCASTLE (N.S.W.).—City Council.
330 miles h.d. cadmium copper cable (£13,366).—Wm. Adams & Co., Ltd. —*Tenders.*

Ayrshire.—Committee of Glenafton Sanatorium. Accepted:—
Installing electric lighting (£1,172).—Cowan & Linton.

Chesterfield.—Electricity Committee. Accepted:—
Four miles of e.h.p. cables (£7,554).—Macintosh Cable Co., Ltd.
Five miles of miscellaneous l.p. cables (£2,003).—W. T. Glover & Co., Ltd.

Glasgow.—Electricity Committee. Recommended:—
200 electric kettles.—Bulpitt & Sons, Ltd.
25 hot-water tanks (17 gal.).—A. Low & Sons, Ltd.
12 hot-water tanks (2 gal.).—W. C. Yuille & Co., Ltd.
400 hot plates.—Metro-Vick Supplies, Ltd.
Repair of the core of No. 2 alternator (£815) at Dalmarnock power station.—Metropolitan-Vickers Electrical Co., Ltd.

Corporation. Recommended:—
Electrical installation for the Stockwell Street improvement scheme (£2,316).—Johnston, Park & Co.
Electric lift (£2,229).—John Bennie, Ltd.

Tramways Committee. Recommended:—
Boiler pans.—McCreath, Taylor & Co., Ltd.
Steel rails.—Bolckow, Vaughan & Co., Ltd.
Heaters for tramcars.—Siemens Electric Lamps and Supplies, Ltd.; W. Bray & Co., Ltd.; A. Low and Sons, Ltd.; A. C. Borthwick; Credenda Conduits Co., Ltd.
D.c.c. wire.—W. T. Henley's Telegraph Works Co., Ltd.

Grimsby.—Electricity Committee. Recommended:—
Rearranging pipes at boiler house (£180).—J. Spencer, Ltd.
Fan and chimneys for boilers at electricity works (£320).—Stirling Boiler Co., Ltd.
Air filter for turbo-alternator (£112).—Metropolitan-Vickers Electrical Co., Ltd.

Hertford.—Town Council. Accepted:—
Wiring houses on the Bengeo estate for electric light and supplying fittings, &c. (£271).—Woolland & Co.
Connecting services to the mains (£250).—North Metropolitan Electric Power Supply Co.

Ilford.—Tramways Committee. Recommended:—
Electrically-driven portable concrete breaker (£241).—Reavell & Co., Ltd.

London.—HAMMERSMITH.—Electricity Committee.
Four dampers for No. 1 economiser (£125).—Sterling Boiler Co., Ltd. (Accepted.)
Wire guards for the switchboard cubicles (£127).—F. W. Potter & Co., Ltd. (Recommended.)
Four additional sets of terminal connections for reactors (£155).—British Thomson-Houston Co., Ltd. (Recommended.)

BATTERSEA.—Electricity Committee. Accepted:—
Repairs to rotary convertor (£150).—English Electric Co., Ltd.

STEPNEY.—Electricity Supply Committee. Recommended:—
Current limiters for 12 months (£525).—Reason Manufacturing Co., Ltd.
Conduits, troughs and covers for 12 months (£2,321).—Albion Clay Co., Ltd.
Combined meters and demand indicators.—Aron Electricity Meter, Ltd.
5-20-amp. meters.—Reason Manufacturing Co., Ltd.
Prepayment and 50- and 100-amp. meters.—Chamberlain and Hookham, Ltd.

Mansfield.—The Electricity Committee has recommended the Council to renew for twelve months the contract of the Netherlands Cable Works, Ltd., for the supply of h.p. and l.p. cable.

New Zealand.—AUCKLAND.—City Council. Accepted:—
One "Blackstone" 76-b.h.p., 2-cylinder, heavy fuel-oil engine.—Blackstone & Co., Ltd.

Perth.—Electricity Committee. Recommended:—
New feeder cable (£4,000).—Callender's Cable & Construction Co., Lfd.

Stoke-on-Trent.—Electricity Committee. Accepted:—
12,500-kW turbo-alternator and condensing plant (£46,251).—Metropolitan-Vickers Electrical Co., Ltd.
Overhead transmission line to Leek (£7,600).—John Collier & Co. (Electrical Engineers), Ltd.
Underground mains (£6,750).—Callender's Cable & Construction Co., Ltd.
Switchgear, control gear and transforming equipment (£6,750).—Metropolitan-Vickers Electrical Co., Ltd.

Forthcoming Events.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, June 2nd. Esplanade Hotel, Porthcawl. 5.30 p.m. Annual general meeting.

Institution of Civil Engineers.—Charter Celebration and Engineering Conference, London, June 3rd to 7th. Monday, June 4th, 4.30 p.m. James Forrest lecture, "A Century of Inventions." Sir James A. Ewing, F.R.S.

British Electrical Refrigeration Campaign.—June 8th to June 25th.
Thursday, June 7th, at the Hotel Cecil, Strand, W.C., at 1 p.m. Luncheon.

Society of Engineers (Incorp.).—Saturday, June 9th. 3 p.m. Visit to the London Terminal Aerodrome, Croydon.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

EXALT 5-amp. switches.
EXIMPEX mercury time switch.

Notes.

Sydney Bribery Charges.

The local correspondent of *The Times* reports that on May 28th Mr. S. Y. Maling, assistant general manager of the Sydney (N.S.W.) Electricity Department, gave further evidence before the Royal Commission which is investigating charges made against him and Labour aldermen of receiving bribes in connection with a large power-plant contract. Mr. Maling said that while in New Zealand he received a letter from a diver and moneylender named Albert (who was previously alleged to have acted as an intermediary in the matter) urging him to leave in a foreign ship and on no account to return to Sydney.

In another letter which he read to the Court Mr. Maling expressed fear that Albert might injure him physically on his return to Sydney and suggested police assistance. Mr. Maling said he had never seen Mr. Arnot, the manager of Babcock and Wilcox, Ltd., since he had returned to Sydney. The payment of £1,200 into the Melbourne offices of a bank represented a loan from his brother, who is Sydney manager of the Metropolitan-Vickers Company.

Central England Electricity Scheme, 1928.

Copies of the above scheme published by the Electricity Commissioners can be obtained from H.M. Stationery Office in London and Edinburgh. Price 1s. 6d. each. (See our advertisement pages to-day.)

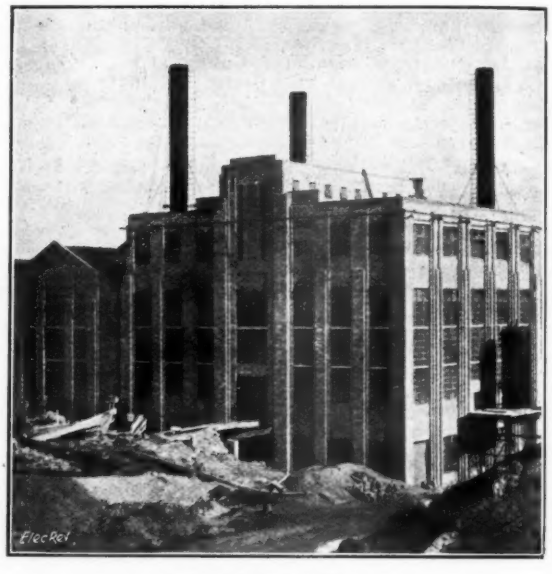
Educational.

The summer evening classes of the Manchester Municipal College of Technology will commence on June 11th and 12th, and, except when a different number of meetings is specified will continue until July 24th. The electrical engineering syllabus covers: Electric traction calculations, heating and cooking appliances, electrical laboratory, 132-kV transmission lines, and electricity applied to coal mining.

The entrance examinations for the award of British Empire Scholarships in the Faculty of Engineering, Loughborough College, have now been completed and the awards made. The scholarships are tenable at Loughborough for the full period of the diploma course, open to all British subjects resident in any part of the Empire, and are of the value of £75 per annum. Applications were received from a large number of the public and secondary schools in England, South Africa, Malta, Palestine, India, and the Federated Malay States.

Hayle Power Station.

The accompanying illustration shows the exterior of the fine



Hayle Power Station.

new power station which is being built for the Cornwall Electric Power Co., Ltd., at Hayle, Cornwall.

"Greater Brighton" Illuminations.

The illumination scheme provided at Brighton for the "Greater Brighton Week," which opened on May 28th, reveals some unusual effects. The Corporation electrical engineer, Mr. J. Christie, M.I.E.E., in collaboration with the General Electric Co., Ltd., has evolved a scheme of lighting which excels anything hitherto attempted in the history of Brighton. A great blaze of light greeted T.R.H. the Duke and Duchess of York at the inaugural ceremony which they performed on May 30th. The Royal Pavilion is flooded with a sea of amber, red, and green light from some thirty floodlight projectors, while the Old Steyn Gardens are garlanded with thousands of multi-coloured lamps; the War Memorial and Fountain and St. Peter's Parish Church are also floodlighted by means of powerful projectors, and the new Aquarium is likewise illuminated on very elaborate lines.

It is along the front, however, stretching the whole length of the promenade from the Palace Pier to the West Pier, and along to the Edward VII Memorial at the Hove sea wall boundary, that the great blaze of light provides scenes of exceptional brilliance. Massive double-unit lighting standards carrying twin Wembley lanterns of imposing design, each equipped with two 1,500-watt lamps and bearing the Brighton coat of arms, are placed along the entire front at 120-foot intervals, and this lighting is supplemented by nearly two miles of Fairyland strip carrying upwards of 10,000 colour-sprayed lamps. The boating pool and Valley Gardens are also floodlighted by novel methods.

The Overhead Lines Association.

The next meeting of the O.L.A. will be held on July 6th. On the invitation of Mr. W. A. Turnbull, A.M.I.E.E., borough electrical engineer of Aylesbury, Bucks., and member of Council of O.L.A., the Association will meet at 3 p.m. in the Trades and Industrial Exhibition, Aylesbury, for tea. The following meeting, July 18th, will be held on the invitation of the president, Mr. R. Borlase Matthews, M.I.E.E., at his electric farm, near East Grinstead.

Dynamotor Standards.

The Institution of Automobile Engineers and the Society of Motor Manufacturers and Traders have just issued a revised sheet of a provisional standard of dimensions of combined dynamos and motors used for lighting and engine starting purposes on motor vehicles.

Appointments Vacant.

Meter superintendent for the City of Worcester electricity department. Teachers in electrical engineering and engineering drawing, for the East Ham Technical College, Evening Classes. Shift charge engineer for the county borough of South Shields electric supply department. Sales representatives for the Credenda Conduits Co., Ltd. One or two general assistants (£260-£300) for the Northampton Electric Light and Power Co., Ltd., and associated companies. Visiting teachers in electric installation, telephony and telegraphy, metallurgy, engineering economics. Mechanical engineering, combustion engineering, boiler maintenance, and automatic sub-stations, for the L.C.C. School of Engineering and Navigation, Poplar. Switchboard attendant for the Borough of Buxton Electricity Department. (See our advertisement pages to-day.)

An appointment in our last issue for a meter tester and reader for the Cheadle and Gatley Electricity Department gave the last day for applications as *Thursday*, June 5th. This, of course, should have been Tuesday.

Large Automatic Hydro-electric Station.

What is claimed to be the largest automatically controlled hydro-electric station in the world will soon be in regular operation on the Ohio River. Located at Shipping Port, Kentucky, this station was recently completed for the Louisville Hydro-electric Co. The present installation consists of eight 12,550-kVA vertical-shaft generators, 14,000 V, but space is provided for two more generators which will bring the ultimate capacity of the station up to 125,500 kVA. The principal feature of the station is the electrical layout. The conventional switchboard has been entirely eliminated and replaced by individual control panels installed in "cubicles" alongside of each generator. Each cubicle contains relay mechanisms for starting, running and stopping its generator, together with protective equipment for various emergency conditions. In addition, a synchronising and voltage-checking device makes it impossible to connect a generator to the bus-bars until the electrical conditions are correct. Pull-button switches are built into the front doors so that starting can be carried out with minimum delay. Each generator is connected through large oil circuit breakers to upper or lower bus-bars, these being connected to transformers which step up the pressure to 66,000 volts for transmission. A complete and simple supervisory equipment makes it possible to assemble the control and metering of all the generators on a single panel at the desk of the supervisor. This panel is approximately six feet long by three feet high by 1 foot deep, and on it are mounted ten banks of meters and keys by which the condition of each generator and transformer bank can be read, and its operation controlled, by one man. In normal service the station is under the management of a supervisor, centrally located at his controlling cabinet. When the load demand increases, the supervisor indicates by means of a signal light on a generator cubicle that that machine is needed on the line. The floor attendant immediately operates the starting button on the cubicle, and the gate-operating mechanism is put in motion, bringing the generator up to speed. As soon as the machine is in rotation the automatic-control devices come into play and the incoming machine is placed on the bus-bars as soon as its electrical conditions are correct. The supervisor then takes charge, manipulating the load to the best advantage from his desk. Ordinary routine at the station calls for hourly inspection of the meters and instruments in each cubicle, and this duty keeps the attendant employed when not starting a machine. In times of emergency the throwing of a single switch in the cubicle makes all control operations manual. The equipment was supplied by the General Electric Co., America.

Fires in London.

The Report for 1927 of Dr. Waldo, H.M. Senior Coroner for London, states that of the 171 fires reported upon by him under the provisions of the City of London Fire Inquests Act, 1888, 28 were electrical in origin. Of this number, in 14 cases fire and explosion occurred in electrical distribution boxes located in public City footways. The boxes belonged to the City of London Electric Lighting Co., the Charing Cross Electric Supply Co., and to the General Post Office; and the cause of the fires and explosions as officially reported was "defective electrical circuit." In no case was there any evidence of the presence of coal gas in connection with the explosions, and it has been suggested that the fumes given off by the bituminous covering of the cables caused the explosions.

In Dr. Waldo's Annual Report for 1925, in referring to 15 similar cases, he said: "So far these fires, producing extensive and dangerous upheaval of the footways, have not, happily, resulted in any deaths in the City, but several narrow escapes from death have occurred. I would suggest that a careful investigation of the root cause of these dangerous fires and explosions be made by the responsible authority (the Ministry of Transport), with a view, if possible, to their prevention." He has also suggested on more than one occasion that new up-to-date regulations might usefully replace the old Board of Trade Regulations with a view to securing the safety of the public. In reply to a recent letter (January, 1928) addressed to the Minister of Transport, he received a communication from the Electricity Commissioners to the effect that the suggested regulations were still under consideration.

In addition to the 14 electrical distribution box fires above referred to, 14 fires in City buildings, due to defective electrical circuits, came under his investigation during 1927. As in former annual reports, he suggests that the compulsory adoption in the City of London of the wiring rules of the Institution of Electrical Engineers would prove a cheap insurance against loss of life and property.

An Aluminium Plating Process.

An interesting announcement is made to the effect that Messrs. Malcolm Owen, Ltd., have acquired a licence to apply the process of Messrs. Stafford O'Brien & Co., of imparting to aluminium in sheet, spun, or cast form coatings of zinc, nickel, copper, chromium, or any combinations of those metals. It is an electrolytic plating process which is said to be inexpensive and quite commercial, enabling the articles being plated to be transferred from one bath to another without complication. Anodic treatment results in the formation of a thin skin of oxide on the aluminium, which is non-conducting and non-corrodable in the ordinary atmosphere. This treatment, when not carried to its full extent, prepares the surface of the aluminium for the deposition of nickel upon it and of a coating of copper upon the latter. If required, after the copper film has been polished, a final coat of chromium can be deposited upon the other two, the finished article being bright and clean in appearance, thus obviating the need for polishing the chromium surface, which is, of course, very hard. It is claimed that the coatings are adherent and not liable to strip, and that acid and salt-spray tests have been applied with satisfactory results. Aluminium alloys may be similarly coated without difficulty when their copper content is, say, not in excess of 6 per cent., preferably 3 per cent. Moreover, a further process is to treat aluminium electrically so as to render its surface non-corrodable and at the same time impart to it a good looking iridescent effect, somewhat akin to "mother of pearl," which will withstand a considerable amount of ordinary wear and tear. Plant has been installed in London for carrying out the process on a commercial scale, the object being to stimulate the use of aluminium for purposes for which its light weight particularly fits it, and harden its surface so that it will retain its bright polished appearance and avoid the necessity for constant cleaning.

Current Density in Accumulators.

In certain types of modern lead accumulators plates are employed of a light construction and of great vertical height. The combination of these two factors has a bearing on the distribution of current in the cell, which has been investigated by an indirect method and is described by Messrs. J. T. Crennell and F. M. Lea in the *Journal* of the Institution of Electrical Engineers. The results obtained are applicable to any cell with pasted plates of about ¼ in. thickness: a method of determining the variation of current density with depth has been applied to a particular type of cell (37-plate) of about 4,000 ampere-hour capacity discharging at 500 amperes. Data regarding the variations in acid density at different depths in such a cell during discharge were available, and formed a rough check on the accuracy of the method. Little previous work seems to have been carried out on this subject: important factors which determine the value of the current density at any part of a plate are plate resistance, electrolyte resistance, and plate polarisation, the magnitudes of which factors may either be calculated or determined experimentally. The method employed is to obtain a relation between the factors mentioned above and the current densities at two levels in the cell by following the potential changes occurring round a closed circuit in the cell; by evaluating the other quantities involved in the equation thus obtained, the change in current density with depth may be determined.

Railway Radio Signalling.

Promising results are being secured by the use of radio intercommunication on long freight trains in America, as shown by tests now in progress on the Chesapeake and Ohio Railways, according to the Westinghouse Electric and Manufacturing Co. The system is in service on the James River subdivision, where it is being tried because ordinary signalling is very difficult under the conditions that obtain in that mountainous region. The line has many curves and several bridges and tunnels, and is so tortuous that engine and "caboose" are rarely in sight of each other and often on opposite sides of a mountain, so that signalling by hand or lantern is generally out of the question. Trainmen usually have to walk within signalling distance in order to enable trains to make the proper movements, and since the trains are upwards of a mile long, much time is lost by this process, and delay anywhere along the line upsets schedules for the whole subdivision. Radio signalling between engine and "caboose" saves so much time in various ways that a considerable fuel saving per trip is made, not only by the train equipped with radio, but by all trains whose movements are dependent on the radio-equipped train. A transmitter and

receiver, with a loud-speaker, are mounted on both the engine and the "caboose," and complete vocal intercommunication is maintained on the entire trip: clear loud-speaker volume is normally maintained, though there is a little, but not serious, fading when passing under trussed steel bridges. In tunnels, between high bridges, beside high cliffs, and in deep cuts, fading is more pronounced, though communication is always maintained by means of head-'phones; it is, however, not difficult to correct this trouble at the points where it is serious. The range of the system is several miles, so that even the parting of the train does not sever communication.

Synchronous Motors with Magnetic Clutches.

During the past five years an increasing number of synchronous motors has been installed in steel works for various purposes, the largest to date being the 9,000-h.p., 107-r.p.m., 6,600-volt synchronous motor on main roli service in the continuous sheet-bar mill of the Corrigan-McKinney Steel Company at Cleveland, U.S.A. In this country synchronous motors are being used for various purposes, though starting difficulties have been experienced, for instance, on hydraulic accumulator work, and, while steel works engineers readily admit the economy of the synchronous motor, as regards its power-factor-raising properties, many of them have hesitated to install it on account of the starting difficulties, preferring to use motors with high starting torques. In a large number of cases, however, the problem has been met by installing a magnetic clutch between a synchronous motor and the driven machine, the motor being allowed to run up to speed without load; the clutch is then engaged, and the load in consequence is taken up smoothly and without jar.

For instance, in one large steel works the hydraulic pumps are driven by three 2,220-volt, 150-h.p., synchronous motors, and a magnetic clutch transmits power through a chain drive to the pump shaft. In another case Igranic type clutches have been adopted with squirrel-cage motors on triplex pump drives for accumulator service to punches and hydraulic presses, the clutches running for about 15 seconds to 30 seconds with five-minute intervals all day long. Another clutch is used on an oil-pressure system (2,750 lb.), working for five to 20 minutes at 30-minute intervals, according to the demands on the system. It is thus found that, by installing a magnetic clutch which does not, by reason of its nature, "grab" the load, but picks it up gradually while the magnetic force is building up between the two clutch members, simple squirrel-cage or standard synchronous motors can be used for drives which they cannot otherwise handle effectively.

The Domestic Load in Toronto.

The following is the complete text of the note referred to by Mr. F. W. Purse in our "Correspondence" columns last week; it appeared in the *Electrical World* of May 12th:—About eighty-six thousand users of electricity in Toronto have been called upon to pay more for their power and light by reason of an upward adjustment of rates announced by the Hydro-Electric Power Commission of Ontario. On houses of six or seven rooms the increase is about 14 per cent., while in the larger homes of ten or twelve rooms the boost is about 29 per cent. The minimum rate is now 1½ cents per kilowatt-hour, with 10 per cent. discount for prompt payment, compared with 1 cent per kilowatt-hour, with the same discount, the rate which prevailed for some years. Moreover, consumption in excess of 9 kWh per 100 sq. ft. of floor area will cost 2 cents per kilowatt-hour for the excess consumption, except where consumers use electric cooking ranges, when an additional 200 kWh will be allowed at the 1½-cent rate.

The announcement intimates that the revision upward has been necessary because domestic consumption has passed beyond the limits of off-peak supply. The "object of the adjustment," continues the announcement, "is not so much to collect more revenue from the customers who are using an amount of power comparable with what they used in 1916 as to correct the tendency toward increasing loss which results from larger and larger consumption of excess power sold at a decreasing average rate with an increasing average cost."

The new rates are as follows:—

Floor area charge, as at present, 3 cents per 100 sq. ft. per month

First 3 kWh per 100 sq. ft. of floor area per month, as at present, 2 cents per kilowatt-hour.

Next 6 kWh per 100 sq. ft. of floor area per month, 1½ cents per kilowatt-hour.

Consumption in excess of 9 kWh per 100 sq. ft. of floor area per month at 2 cents per kilowatt-hour, subject to an allowance to customers having electric ranges of an additional 200 kWh per month at 1½ cents.

Prompt payment discount.—One cent per 100 sq. ft. of floor area per month.

Private Bills.

The Cleveland and Durham County Electric Power, and the Wessex Electricity Bills have been read a third time in the House of Lords and passed. The Stretford and District Electricity Board Bill and the York Town and Blackwater Gas and Electricity Bill have been read a second time in the House of Commons.

Electrical Normalising of Steel.

It appears from tests described by Mr. W. E. Woodward in a paper, "The Rapid Normalising of Overstrained Steel," presented before the Iron and Steel Institute, that in order to obtain absolutely concordant results, the normalising must be effected by means of direct current. For all practical purposes, however, the use of alternating current seems to be sufficient. In both cases the grain-size can be carefully controlled and rendered extremely small in an astonishingly short space of time. Further experiments on the effects of time and rate of heating are being carried out.

Proposed Electro-Technical Exhibition at Moscow.

The board of the Russian Supreme Economic Council has informed the Moscow Town Council that during the discussions of the question of organising an international electro-technical exhibition it had been found that Moscow was the most suitable city in which to hold the exhibition. The Supreme Economic Council asks whether the Moscow Council could offer the use of the site of the former agricultural exhibition, and what help it could give towards carrying out the project. It is proposed to hold the exhibition in 1929.—*Reuter's Trade Service* (Moscow).

Shut-Down at Johannesburg.

Owing to a blow-out on a feeder cubicle at the municipal power station, Johannesburg, on May 8th, four electricians were burned, three of them seriously, and the city's entire electricity service was cut off for more than two hours. The mishap which, according to the *Cape Argus*, was due to a "short circuit," caused by a mouse getting across a set of terminals, took place at about 12.40 p.m. Tramways and industrial and other establishments dependent upon electricity from the municipal service were entirely at a standstill until the damage at the power station had been rectified. The names of the injured electricians are R. G. Unwin (burns to face, head and legs), C. Crawford (burns to face, back, head and leg), J. W. Cleaves (burns to face and arms), J. Nicholls (burns to face, head and hands). The condition of all the injured, with the exception of Nicholls, is described as serious. One native was also slightly burned on the arm.

Tungsten Magnet Steel.

When the fact was discovered that a relatively small amount of silicon retarded, or, as it was at first thought, stopped the formation of tungsten carbide, it was hoped that higher percentages would possibly eliminate the "spoiling" effect produced by reheating the steel for rolling or forging. A paper on "The Effect of Silicon on Tungsten Magnet Steel," read before the Iron and Steel Institute by Mr. J. Swan, shows that this has not proved to be the case, and that it is still necessary for magnet steel manufacturers to use a maximum reheating temperature for rolling of the order of 1,200 deg. C., if the utmost efficiency from tungsten-steel is desired. It is true that 1.0 per cent. of silicon reduces the loss of coercive force on annealing or soaking by about a half, but this is offset by the inferior all-round magnetic properties of the steel, although a steel with lower carbon, tungsten and chromium contents than those of the test-pieces would be expected to give a better result. The results of a few tests suggest that in the silicon steels the loss due to ageing is considerably less than in steels without an appreciable amount of that element. The effect of the silicon in retarding tungsten carbide segregation forms a basis for the explanation of the larger volume change on hardening tungsten-die steel, which results in the progressive contraction of the bore of circular drawing dies on repeated quenching, a property so much desired by users.

Tests of Hearing.

Ear tests developed in the Bell Telephone Laboratories, New York, make use of accurate electrical instruments which, with psychological aids, determine a person's exact degree of hearing. False claims of either deafness or exceptional hearing are of no avail, for the truth can now be easily discovered. A push-button on the instrument which measures the tone emitted for the test permits the interruption of the sound at any moment. If a patient says he hears a tone, and then claims that he still hears it when it has been cut off, it is evident that he has been deceiving himself. Another device makes it possible to switch the sound to either ear or both. A loud tone in either ear causes the eye nearer it to blink slightly, though the patient may claim that he hears nothing. The patient is made to read aloud in his normal voice in another test, while a tone is switched from ear to ear. If he is deaf in one ear, he will raise his voice every time the tone sounds in his normal ear. When the tone is switched on and off both ears, a person with normal hearing will raise his voice each time the tone is turned on, while one who is deaf will continue to read without changing his voice. To detect a false claim of deafness in one ear, the tone is switched repeatedly back and forth between the ears at varying intensity, and the patient is asked to signal each time he hears a sound. A truthful signal can be made almost instantaneously, but if the patient must stop to decide each time in which ear he hears the sound, much more time is required and he quickly becomes confused, thus betraying himself. These tests are expected to prove valuable in compensation cases in which loss of hearing is involved.—*Science.*

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

We have pleasure in following up our last week's leaderette references to the services rendered by Mr. F. B. O. HAWES, the honorary secretary of the Electrical Trades Benevolent Institution, with a recently-taken photograph of that gentleman. Mr. Hawes is one of the few prominent men whose record is not to be found in the reference books, but we may supplement the information given in our last issue and that given in the vote of thanks at the annual meeting of the Benevolent Institution, with a word or two. Mr. Hawes left the position of secretary to the original Langdon-Davies Motor Co. to follow the late Mr. Walter Davenport in the secretaryship of the National Electrical Manufacturers' Association, and while occupying that position he acted as secretary of the very successful electrical exhibition held by the Manufacturers' Association at Olympia in September, 1911. It will be remembered by some of our readers that of that Exhibition the late Sir William Preece was president, and Mr. H. W. Butler chairman of the Executive. It was about this time that Mr. Hawes resigned the secretaryship of N.E.M.A., which, in 1911, underwent reorganisation, and took the much larger shape of the B.E.A.M.A., with Mr. D. N. Dunlop as secretary. Mr. Hawes had been in the thick of the fight at the first Olympia Electrical Exhibition in 1905, and in one of our issues in 1911 he was described as having been "for many years in the inner councils of the Electrical Manufacturers' Association." Since 1911 Mr. Hawes has been connected with electrical trade organisation and trade association work generally, and he so continues to-day. During all that period, as stated in our last issue, he has been very closely identified with the work of the Benevolent Institution. It will be obvious that he is a man possessing special knowledge of the electrical trade.

Elliott & Fry] *[London.*

Mr. F. B. O. Hawes,
Honorary Secretary of the E.T.B.I.

Mr. W. C. JEARY has resigned his position as London showroom manager of the General Electric Co., Ltd., and has been appointed sales manager of Messrs. L. G. Hawkins and Co., Ltd., of Drury Lane, W.C.2. He will take up his duties to-day, June 1st.

Major GORDON KENNARD, late R.E., who before the war was London engineer to the Westinghouse Cooper-Hewitt Co., and who raised and trained the 56th Divisional Signals R.E., 29th Divisional Signals R.E., and 58th Cyclists, subsequently commanding the 56th until nearly the end of the war, spent some time in hospital, but recovered, and after the war became chief assistant engineer to the Associated Portland Cement Manufacturers, Ltd. However, after four years he returned to hospital and has lain in a cement case in a sanatorium at Davos-Dorf, Switzerland, for five years. Happily, he will be able to walk again this summer.

Mr. THOMAS L. NORFOLK, A.M.I.E.E., for seven years principal assistant to the engineer-in-chief, has been appointed engineer-in-chief of the Mersey Docks and Harbour Board, as from July 2nd. Mr. Norfolk is a member of the Institutions of Civil and Mechanical Engineers, and for ten years he was on the dock engineers' staff of the North-Eastern Railway—for the last five years of which period he was principal assistant to the joint engineers for the construction of the King George Dock at Hull. In 1914 he entered the service of the Mersey Docks and Harbour Board, and five years later became assistant to the engineer-in-chief. His salary, it is said, will be in the region of £4,000 per year.

Mr. S. R. WINDLE, the late borough electrical engineer at Doncaster, who takes up a similar position at Grimsby, has been presented by the chief officers of the Corporation with an oxidised silver clock.

Mr. MITCHELL HODGE, engineer, Dellingburn Electricity Works, Renfrewshire, has been presented with a gold wrist watch by the staff and employés on the occasion of taking up an appointment in Vancouver B.C.

At a meeting on Friday (May 25th) of Glasgow Corporation Electricity Committee it was agreed to recommend that Mr. HERBERT BELL, M.I.E.E., city electrical engineer, Hull, should be appointed manager of the Glasgow Electricity Department.

At the Glasgow Corporation meeting on May 24th, the minute containing the recommendation that Mr. R. B. MITCHELL, who recently resigned from the position of general manager of the Electricity Department, should be granted a superannuation allowance of £764 per annum was taken back.

Mr. H. K. FOSTER, whose portrait accompanies this note, has just resigned the position of manager of the electric lighting and power plant of Vickers-Armstrongs, Ltd., Sheffield, after 26 years' service with the company. He is taking over a private business at Bedford, and prior to his departure he was presented with a writing table and a wardrobe by his colleagues. Mr. Foster is an Associate Member of the Institution of Electrical Engineers. Mr. W. J. L. COPE, for six years assistant electrical engineer, has been appointed to the vacancy.

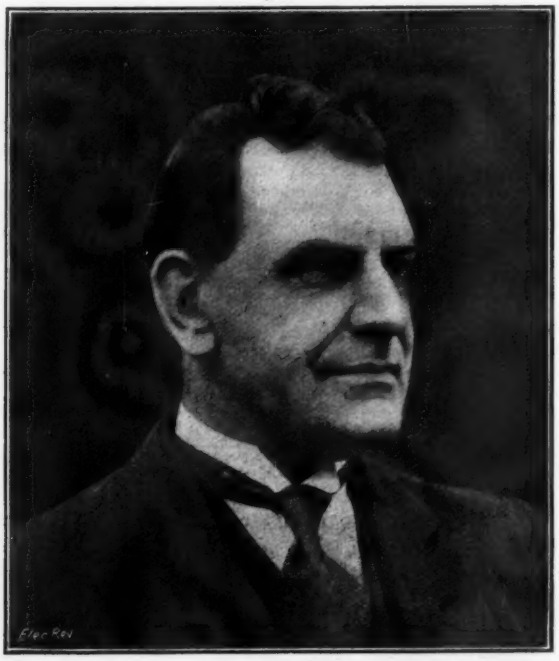
Mr. H. K. Foster.

Mr. ROBERT HASLAM, who has retired, after 38 years' service with Callender's Cable & Construction Co., Ltd., Belvedere, has been presented by his colleagues with a gold watch, a cheque, and an album, containing the names of the subscribers. He also received from friends a replica of a cable drum, silver mounted, and hollowed to hold cigars.

On the occasion of his departure from Ireland to join members of his family in Australia, Mr. THOMAS TOMLINSON was presented by his colleagues and friends with an album containing an illuminated address, a cheque, and a case of pipes. Mr. Tomlinson's lengthy connection with electrical matters in Ireland was referred to in the ELECTRICAL REVIEW for May 18th. During the last 30 years he has been connected with the introduction of electricity into the country on the occasion of the lighting of Carlow, Larne and Bray.

The Leicester City Council has approved the appointment of Mr. E. A. MILLS as deputy chief and manager of the electricity undertaking, at £800 per annum. At present Mr. Mills is executive engineer of the power station of the municipality of Shanghai.

The Wrexham Corporation has appointed Mr. J. W. WILLIAMS, whose portrait appears herewith, to the position of electrical engineer. Mr. Williams commenced his career in the shops of the Plaspower Colliery, and joined the Wrexham electricity works in 1903. He subsequently went to the South African gold mines as an electrical engineer, but returned in 1913 to become station superintendent at the Caernarvon elec-



W. S. Williams. [*Wrexham.*

Mr. J. W. Williams,

The Electrical Engineer of Wrexham.

tricity works. During the war he joined the Navy, eventually being placed on specialist work in submarines in connection with torpedoes. He went to Wrexham as station superintendent in 1920, and since October last had been acting electrical engineer.

The Basingstoke Town Council has decided to pay the borough electrical engineer a fee of £100 for extra services in connection with obtaining a special order and for additional work in carrying out the scheme of extension within the rural area.

Hammersmith Borough Council Establishment Committee recommends that Mr. J. DAY, district mains superintendent, be designated mains superintendent and placed in Grade 3, Class F, of the N.J.B. scale, at present £556 per annum (inclusive).

Obituary.—MR. W. E. FREIR.—We regret to learn of the death, which occurred suddenly in France while in the Rome-Paris express returning from the Congress of the Union Internationale de Tramways, of Mr. William Edwin Freir, editor of our contemporary, the *Electric Railway and Tramway Journal*. The sad event happened on May 18th, one day after his 80th birthday. The funeral took place at Enfield on Friday last. The editors of various other trade and technical journals will share with the editors of the ELECTRICAL REVIEW in their feelings of regret at the loss of one of their oldest comrades of the Press whom it has been a pleasure to meet at many tramway and allied functions during twenty years at least.

ALFRED ROSLING BENNETT.—We have to announce with much regret the death of Mr. A. R. Bennett, a veritable pioneer amongst British telephonists. Mr. Bennett was born in London on March 14th, 1850. In 1869 he entered the service of the Indian Government Telegraphs, returning to England in 1873. After a few years as electrician to the Highton Batteries Company, he engaged in literary pursuits, and was for some time editor of two London periodicals. He was associated with the demonstration in 1877 of Cromwell Varley's musical telephone exhibited at the Queen's Theatre, Long Acre, connected by overhouse lines with the Canterbury Music Hall. Both theatre and music hall have long since vanished. It was in May, 1880, that Mr. Bennett's connection with the speaking telephone commenced. In that month he was appointed engineering superintendent of the East London district by the United Telephone Company. In 1881 he joined Messrs. D. & G. Graham, who had started a telephone exchange system in Glasgow. This was acquired in 1883 by the National Telephone Company, to whom Mr. Bennett transferred his services, and with whom he remained until 1890, which date coincided approximately with the expiry of the controlling telephone patents. Henceforward, Mr. Bennett's career was that of an indefatigable advocate of competitive telephony. A "mutual" company was formed, to which he became general manager. This was taken over by the "New" Telephone Company—an old company revived with the Duke of Marlborough as chairman. The Duke and his financial colleagues came to appreciate that competitive telephony was of doubtful expediency, and joined forces with the National Telephone Co. On the failure of competition by private enterprise Mr. Bennett turned to municipal competition. This development was largely incited, and almost entirely controlled by him. Glasgow, Tunbridge Wells, Portsmouth, Brighton and Hull developed competitive systems under Mr. Bennett's directions. All, except Hull, were incorporated with the National Exchanges after strenuous efforts on Mr. Bennett's part to maintain their separate existence. He also started an exchange in Guernsey, which had no competition, and which has made satisfactory development. In the "History of the States of Guernsey Telephone System," recently published (1926), Mr. Bennett records its beginnings and progress in great detail, and to some extent fights his early battles elsewhere over again. With the absorption of the municipal systems, Mr. Bennett's active telephone work ceased, except for Guernsey and minor interests. He was imbued with the potentialities of the telephone, believed in its growth, and advocated low rates of charge. As a propagandist he was successful. If he could but have seen that the realisation of his forecasts implied as of necessity considerable devolution in the various branches of the work, and that progress required some tolerance for the views of others on various details, his services to telephony would have been the greater. It had to be realised that low rates were not to be obtained by cheap construction methods of individualistic types. Though the "stormy petrel" in the telephone field, he was little disturbed by opposition, and controversy seemed to be a source of enjoyment. Mr. Bennett patented several inventions, and was the first to put into use the "translator" coil for connecting earthed with metallic circuit lines. He was the author of "Telephone Systems of the Continent of Europe," numerous papers and pamphlets, and some reminiscences of London and Londoners in the 'fifties and 'sixties.

MR. E. COX-WALKER.—We regret to learn that Mr. Edward Cox-Walker, M.I.E.E., of Hill Garth, Sleights, Yorkshire, passed away at his home on Sunday night, in his ninetieth year. In connection with the celebration of his 89th birthday we published in the ELECTRICAL REVIEW for November 4th, 1927, p. 783, a photograph and account of the career of Mr. Cox-Walker. As stated then, he "was one of the oldest members of the Institution of Electrical Engineers and a pioneer of the telephone." He retired from the business of Cox-Walkers & Partners, of Darlington, in 1923 leaving it in the hands of his two sons, Messrs. Edgar and T. Meredith Cox-Walker.

MR. G. READ.—The sudden death is announced of Mr. George Read, manager for R. & H. J. Pearson (Eastbourne), Ltd., electricians, of Terminus Road, Eastbourne. He had been in the business for about 40 years, and was 61 years of age.

MR. J. RUTHERFORD.—The death has occurred in Wellington, New Zealand, of Mr. James Rutherford (aged 89), father of Sir Ernest Rutherford, O.M., F.R.S.

MR. A. B. PHILLIPS.—The death took place, on May 22nd, at Dartford, of Mr. Arthur Benjamin Phillips, who had since 1896 been in business in High Street as an electrician and dealer in electrical fittings. He was 50 years of age.

HERR O. HENKIL.—The death is reported from Winterthur, Switzerland, of Herr Otto Henkil, chief engineer of Sulzer Bros.

Wills.—Mr. H. DAVEY (Hathorn, Davey & Co., pumping machinery makers, Leeds) left £11,351 gross, and £11,096 net personalty.

Mr. W. E. NICOLL, general manager of the Barnsley and District Traction Co., Ltd., left £2,543 gross and £2,338 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Mica Insulators, Ltd.—Private company. Registered May 18th. Capital, £5,500 in 5,000 10 per cent. cumulative preference shares of £1 and 10,000 ordinary shares of 1s. each. Objects:—To adopt an agreement with J. MacDonald, J. A. Roberts and G. H. Smith, and to carry on the business of manufacturers of mica and other goods at Inverness Works, Southall, and that of manufacturers of heat-resisting and dielectric products, &c. The first directors are:—J. McDonald, M.I.M.E., 13, Drayton Gardens, Winchmore Hill, N.21, marine engineer; J. A. Roberts, 88, Northcote Avenue, Southall, engineer; G. H. Smith, 59, King Street, Southall, general merchant. Secretary: F. H. Conning, C.A., 4, Great Winchester Street, E.C.2.

Franklin Ebonite Co., Ltd.—Private company. Registered May 9th. Capital, £5,000 in 3,750 preference shares of £1 each and 5,000 ordinary shares of 5s. each. Objects: To carry on the business of manufacturers of and dealers in ebonite, synthetic resin compound, bituminous compound, gutta-percha, balata, articles for the chemical and electrical trades, wireless requisites, &c. The first directors are:—S. W. Cox, 11, Monks Hall Grove, Eccles, Manchester; E. Hargreaves, 87, Phœbe Street, Salford; W. P. Cowper, 55, Crossliffe Street, Moss Side, Manchester; J. H. Wray, 97, Wellington Street, Gorton, Manchester (all permanent). Registered office: 47, Franklin Street, Salford, Lancashire.

Richard Johnson & Nephew, Ltd.—Public company. Registered May 24th. Nominal capital, £600,000 in £1 shares (300,000 7 per cent. cumulative preference and 300,000 ordinary). Objects: To acquire the business of wire manufacturers and other businesses carried on by Richard Johnson and Nephew, Ltd. (incorporated in 1900) and carried on at Bradford Iron Works, Manchester, and elsewhere, to take over and undertake all or part of the assets and liabilities of the said company, to adopt an agreement with the British Shareholders Trust, Ltd., and to carry on the said businesses and that of ironmasters, galvanisers, founders, steel convertors, colliery and quarry proprietors, coke manufacturers, smelters, mechanical, electrical and hydraulic engineers, boiler, tube and tin plate makers, manufacturers of electric cables, tram and electric cars, &c. The first directors are: Major E. Johnson, Ashton Hayes, Chester; H. M. Johnson, The Old Tannery, Lymm, Chester, wire manufacturer; T. J. Johnson, Parrey Lodge, Sutton, Macclesfield, wire manufacturer; Lt.-Gen. Sir Walter Campbell, The Red House, Shiplake, Oxon.; J. G. Crozier, Kokine, Parsonage Road, Heaton Moor, near Stockport, secretary and accountant; C. S. L. Trask, 4, The Studios, Edge Street, W.8. Qualification: £250. Solicitors: Pinsent & Co., 6, Bennetts Hill, Birmingham.

Howard Snell & Co., Ltd.—Private company. Registered May 23rd. Capital, £1,000 in £1 shares (400 preference and 600 ordinary). Objects: To adopt an agreement with E. Howard Snell and to carry on the business of radiological engineers, merchants, manufacturers, and suppliers of X-ray, dental, medical, and electromedical apparatus and accessories, and apparatus and accessories for actino-therapy (artificial sunlight), electrical engineering contractors, &c. The first directors are: E. H. Snell, 36 & 38, Victoria Street, S.W.1, radiological engineer; A. C. Greene, Londesborough Lodge, London Road, Worcester Park, medical practitioner. Secretary: A. G. Williams. Registered office: 6, Broad Street Place, E.C.2.

S. & H. Dent's, Ltd.—Private company. Registered May 21st. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers and repairers of or dealers in gramophones, sound-boxes, diaphragms, wireless telegraphy, telephones, and all apparatus for wireless telegraphy; manufacturers and repairers of and dealers in motor-cars, motor-cycles, &c. The subscribers (each with one share) are: C. Halpern and H. Halpern, 29, Heywood Street, Cheetham, Manchester. The first directors are not named. Secretary: C. Halpern. Registered office: 56, Alexandra Road, Moss Side, Manchester.

Wireless Engineering Co. (Scunthorpe), Ltd.—Private company. Registered May 23rd. Capital, £1,500 in £1 shares. Objects: To acquire the business of wireless engineers now carried on by S. Holliday, S. Todd and H. Crooks at Scunthorpe and Frodingham, Lincs, as "The Wireless Engineering Co." The permanent directors are: S. Holliday, 167, Frodingham Road, Scunthorpe; S. Todd, 14, Fox Street, Scunthorpe; H. Crooks, 69, Brumby Wood Lane, Scunthorpe; G. Vickers and Mary E. M. Peart, addresses not stated; W. Bone, 75, Brumby Wood Lane, Scunthorpe. Qualification: £50 shares. Secretary, W. Bone.

Official Returns of Electrical Companies.

W. G. Pearson & Sons, Ltd.—Capital, £6,000 in £1 shares. Return dated April 16th, 1928. All shares taken up. £6,000 considered as paid. Mortgages and charges, nil.

West Witton Electric Supply Co., Ltd.—Capital, £1,000 in £1 shares. Return dated March 17th, 1928. 885 shares taken up. £885 paid. Mortgages and charges, nil.

Gibrico Electric, Ltd.—Capital, £1,000 in £1 shares. Return dated February 7th, 1928. 600 shares taken up. £400 paid. £200 considered as paid. Mortgages and charges, nil.

Electron Co., Ltd.—Capital, £1,000 in £1 shares. Return dated January 23rd, 1928. 970 shares taken up. £970 paid. Mortgages and charges, £2,300.

John Lewis (Wireless), Ltd.—Capital, £100 in £1 shares. Return dated April 16th, 1928. All shares taken up. £100 paid. Mortgages and charges, nil.

Cleveland and Durham Electric Power, Ltd.—Capital, £700,000 in 350,000 preference and 350,000 ordinary shares of £1 each. Return dated April 4th, 1928. 333,705 preference and 157,600 ordinary shares taken up. £411,003 paid on 331,935 preference and 79,068 ordinary shares. £80,302 considered as paid on 1,770 preference and 78,532 ordinary shares. Mortgages and charges, £304,300.

London Electric Stores, Ltd.—Capital, £5,000 in 4,000 preference and 1,000 ordinary shares of £1 each. Return dated September 23rd, 1927 (filed January 3rd, 1928). 3,750 preference and 750 ordinary shares taken up. £3,750 paid. £750 considered as paid. Mortgages and charges, nil.

Power Securities Corporation, Ltd.—Capital, £2,000,000 in 1,000,000 preference and 1,000,000 ordinary shares of £1 each. Return dated March 13th, 1928. 500,000 preference and 500,000 ordinary shares taken up. £1,000,000 paid. Mortgages and charges, nil.

South Metropolitan Electric Tramways and Lighting Co., Ltd.—Capital, £500,000 in 200,000 preference and 300,000 ordinary shares of £1 each. Return dated March 13th, 1928. 200,000 preference and 250,000 ordinary shares taken up. £415,110 paid. £34,890 considered as paid. Mortgages and charges, £128,791.

Ramsden Green, Ltd.—A. J. Carey, of 49, Queen Victoria Street, E.C., was appointed receiver and manager on May 10th, 1928, under powers contained in second mortgage debenture dated July 24th, 1918.

Mexican Hydro-Electric Development Syndicate, Ltd.—Issue on May 14th, 1928, of £250 debentures, part of a series already registered.

Palmer, Riley & Co., Ltd.—Charge on 88, 90 and 94, Abbey Street, Accrington, dated May 10th, 1928, to secure £1,500. Holders: Marsden Building Society, 2, Russell Street, Nelson.

M.S.L., Ltd.—Capital, £500 in £1 shares. Return dated April 13th, 1928. All shares taken up. £500 paid. Mortgages and charges, nil.

Leeds Flint Glass Co., Ltd.—Satisfaction in full on May 1st, 1928, of debentures dated February 1st and August 9th, 1923, securing £10,200 and £700 respectively.

Anglo-Portuguese Telephone Co., Ltd.—Trust deed dated May 1st, 1928 (supplemental to trust deeds dated February 1st and October 19th, 1927) to secure £100,000 debenture stock and premium of 2 per cent. charged on the property, assets and undertaking, charged by the deed of February 1st, 1927. Trustees: H. Allen, 31, Budge Row, E.C., and Second Consolidated Trust, Ltd.

E. K. Cole, Ltd.—Mortgage on Ekco Works, London Road, Leigh-on-Sea, dated May 8th, 1928, to secure all moneys due or to become due from the company to Lloyd's Bank, Ltd., not exceeding £3,000.

Mann, Egerton & Co., Ltd.—Capital, £370,925 1s. in 250,000 preference and 85,389 ordinary shares of £1, and 64,611 ordinary shares of 11s. each. Return dated January 6th, 1928. 210,415 preference and 64,611 11s. ordinary shares taken up. £205,045 paid on 191,434 preference and 13,611 ordinary shares. £47,031 considered as paid on 18,981 preference and 51,000 ordinary shares. Mortgages and charges at date of return: £70,906 (£2,000 since paid off).

Winfield & Reeves, Ltd.—F. Holt, A.C.A., of 46-47, London Wall, E.C.2, was appointed receiver and manager on May 12th, 1928, under powers contained in debentures dated July 8th, 1927, and February 20th, 1928.

Clarke, Chapman & Co., Ltd.—Capital £550,000 in 7,000 preference shares of £10 each and 480,000 ordinary shares of £1 each. Return dated March 9th, 1928. 6,985 preference and 444,060 ordinary shares taken up. £100,210 paid, £413,700 considered as paid. Mortgages and charges, nil.

Isle of Thanet Electric Supply Co., Ltd.—Capital, £500,000 in 282,000 6 per cent. preference, 150,000 ordinary, and 68,000 unissued shares, all of £1 each. Return dated March 28th, 1928. 282,000 preference and 150,000 ordinary shares taken up. £222,000 paid on 222,000 preference shares, £210,000 considered as paid on 60,000 preference and 150,000 ordinary shares. Mortgages and charges: £288,908.

City of Oxford Motor Services, Ltd. (formerly City of Oxford Electric Tramways, Ltd.).—Capital, £150,000 in £1 shares. Return dated March 22nd, 1928. 141,750 shares taken up. £1,007 paid, £140,743 considered as paid. Mortgages and charges: £28,500.

Wellingborough Electric Supply Co., Ltd. — Capital, £50,000 in £10 shares. Return dated March 6th, 1928. 4,500 shares taken up. £45,000 paid. Mortgages and charges: £17,500.

Mather & Platt, Ltd.—Capital £2,500,000 in 40,000 preference shares of £10 each and 2,100,000 ordinary shares of £1 each. Return dated March 14th, 1928. 40,000 preference and 1,363,660 ordinary shares taken up. £630,660 paid on 29,200 preference and 338,660 ordinary shares, £1,133,000 considered as paid on 10,800 preference and 1,025,000 ordinary shares. Mortgages and charges, nil.

Carr & Childe, Ltd.—Capital, £2,000 in £1 shares. Return dated January 16th, 1928. 1,250 shares taken up. £750 paid, £500 considered as paid. Mortgages and charges, nil.

City of Buenos Aires Tramways Co. (1904), Ltd.—Capital, £1,240,000 in £5 shares. Return dated February 29th, 1928. All shares taken up. £1,240,000 considered as paid. Mortgages and charges: £170,737.

Gent & Co., Ltd.—Capital, £50,000 in 20,000 preference and 30,000 ordinary shares of £1 each. Return dated March 15th, 1928. 4,427 preference and 20,876 ordinary shares taken up. £6,887 paid on 957 preference and 5,930 ordinary shares, £18,416 considered as paid on 3,470 preference and 14,946 ordinary shares. Mortgages and charges: £16,500.

Smithfield Markets Electric Supply Co., Ltd.—Capital, £100,000 in 60,000 ordinary shares of £1 each and 8,000 ordinary shares of £5 each. Return dated March 14th, 1928. £60,000 £1 ordinary shares taken up. £60,000 paid. Mortgages and charges: £12,540.

City Notes.

Siemens Bros. & Co., Ltd.

Speaking at the recent annual meeting of this company (whose report was reviewed in our issue of May 18th, p. 875), Mr. G. Mure Ritchie (chairman) said that all the company's investments were valued at or below official market quotations, and were readily convertible into cash. The trade investments included sums expended on a scheme for lighting workmen's dwellings at a fixed price per light per week from which they benefited by the absorption of some of their products, besides obtaining dividends from the company which had been formed to carry out the enterprise. That company was working at Gillingham (Kent), and Waterloo, Rotherhithe, and Poplar in London, and arrangements were being made to extend its activities. The results from the business as a whole during the past year were good but incommensurate with the brains, labour and capital co-operating to produce them. In competing countries, all of which wisely safeguarded their industries, similar co-operation produced much better results. The company had benefited by the absence of industrial troubles and the lower price of coal and other commodities. It might, therefore, be hoped that they were approaching conditions which would stimulate trade and put British industries in a less unfavourable position than they had occupied for many years for competition in the world's markets. Although during the year they obtained a fair proportion of the available business, their manufacturing capacity, with one or two notable exceptions, was not fully occupied. They had manufactured and laid a loaded submarine telephone cable between this country and the Continent, and further cables were supplied for use in Japan, Nova Scotia, and Scandinavia. The demand for submarine cables was sporadic, and during 1927 they had received no contracts of importance. There had been much discussion regarding the position of the cable systems in the light of the development of radio-telegraphy, but it seemed to be generally recognised that the cables were indispensable, and must be well maintained. They felt that, apart from the supply of cable normally required for the maintenance and extension of existing lines, submarine cable would continue to play an important part in the world's communications. Throughout the year their plant for the manufacture of lighting and power cables was again fully occupied, and important contracts were executed for electrical undertakings in all parts of the world. He had mentioned at the last meeting that the company had secured the first important orders placed in this country for a new type of "super-tension" cable from Australia, New Zealand, and Greece. Those contracts had been satisfactorily completed, and further business had been secured from places so far apart as Shanghai, Colombo and Brighton, in addition to which considerable quantities had been laid in London. The telephone department was engaged in the execution of contracts for a considerable number of large public automatic telephone exchange equipments which included the four multi exchange areas of Leicester (4 exchanges), Colwyn Bay (5), Wakefield (3), and Chatham (5). Among overseas contracts for automatic equipments, exchanges for the following were in course of manufacture during the year: Elmwood (Canada), Mukden (Manchuria), and Umtali (Rhodesia), as well as considerable quantities of telephone apparatus for Australia, Brazil, Canada, Denmark, Federated Malay States, and Japan. Of the hundred automatic exchanges which the G.P.O. had brought into service up to March, 1927, the company had supplied 43. Steady progress continued in the supply of signalling apparatus, pyrometers, marine radio-telegraph installations, batteries, &c. The speaker welcomed the Budget proposals for the partial relief of the burden of rates upon industry. He believed that our export trade could not expand to the necessary extent without a large measure of safeguarding such as our rivals enjoyed. If British conditions were near those of our foreign competitors we should be able not only to make larger profits, but to sell at home and in neutral markets as cheaply as they.

Lancashire Electric Light and Power Co., Ltd.

The accounts of this company and its associate, the Lancashire Electric Power Co., were reviewed in our issue of May 18th (p. 875). The annual meeting was held on May 21st, when Mr. A. Shepherd, the chairman, said that the net result of the operating company's working was not so good as anticipated. That was due to several causes, among them being the alteration in the basis of income tax assessment, a loss through the adjustment of coal charges, and the delay in getting the 33,000-V cables into working condition. Those adverse factors had now disappeared and the results of the first quarter's working gave reason for an expectation of a satisfactory increase of profit during the current year. Sanction had been received to the erection of a new generating station at Kearsley on the River Irwell and work was commenced in June last; it was hoped to have the station ready for operation by October, 1929. The Radcliffe station operated satisfactorily throughout the year and the Padiham station had been in commercial operation since January last year. A new 15,000-kW set had been started up at Padiham in October last, and the efficiency of the station had been greatly improved. The mains department had been kept busy in all directions and the company now had in continuous operation at 33,000 V 55 miles of underground cables and 23¼ miles of overhead lines. The demand for lighting and domestic supplies continued to develop at a very satisfactory rate. As the reduction in the earnings of the operating company was not likely to recur and as a large amount of the company's new capital had been employed in such a way that there was only a small return, the directors considered it desirable to transfer from reserve a sum sufficient to enable the same dividends as last year to be paid and to carry forward a small amount.

Oriental Telephone and Electric Co., Ltd.

The annual meeting was held on May 22nd, Sir A. H. McMahon (chairman) presiding. In presenting the report and accounts (*vide* ELEC. REV., May 18th, p. 875), the chairman said that the business continued to make steady progress and the amounts received in dividends from their associated companies had increased, principally due to the larger dividends paid by the Bengal and Madras Companies. The company had now acquired the whole of the issued share capital of the China and Japan Company. The chairman mentioned the way in which the old staff pension fund had been disposed of and then said that fresh capital would soon be required by the company and its associates. It had been decided to replace the manual equipment at Singapore by an automatic exchange; their experience of automatic working in Bombay and Madras had been satisfactory. A contract had been placed for the Singapore exchange and it was hoped to have it working early in 1930. They proposed to write off the cost of the existing equipment over a period of three years. After many vexatious delays new tariffs had been sanctioned in Mauritius, but some time would elapse before all subscribers came on to the new scale. After referring to the operations of the companies in Bombay, Bengal, Madras, Rangoon and Hong Kong, the chairman moved the adoption of the report and the motion was carried.

Westinghouse Electric and Manufacturing Co.

The annual report shows that the sales for the year ended March 31st, 1928, were about $175,000,000; the net manufacturing profit was $14,000,000; the net income available for dividends was $15,600,000; and the earnings per share of stock

(preferred and common) were $6.57, or 13.4 per cent. Dividends were paid during the year on both stocks at the rate of 8 per cent. per annum, or $4.00 per share of $50 par value. These figures indicate a slight decrease in business as compared with the previous year, when the annual sales totalled $185,500,000, and $6.80 was earned per share. After pointing out at the annual meeting that approximately $40,000,000 had been spent in the past six years for new plant and extensions, Mr. Paul D. Cravath (acting-chairman) and Mr. E. M. Herr (president) stated: "All plants have been provided with modern facilities and the company is now equipped to take care of business, at present prices, of more than 25 per cent. in excess of this year's shipments. In providing these facilities, moves were made that enabled the company to inaugurate advantageous mass production methods." The average total number of employés during the year was 41,787, and the total of all pay-rolls exceeded $70,000,000.

Pernambuco Tramways and Power Co., Ltd.

The annual meeting was held on May 21st, Mr. W. Higgins (chairman) presiding. In presenting the report (ELEC. REV., May 18th, p. 876) the chairman said that the bodywork of five double truck closed type cars was prepared in the company's workshops during the year in readiness for the imported equipments, and these would be in service in the near future. Work was rapidly being advanced in the preparation of five more cars. Two tramway extensions comprising together 4 km. of track were completed. Regarding the electricity supply department, satisfactory development continued. Since the inauguration of the 6,000-kW generator in April, 1927, some of the smaller units had been overhauled and the power house was now in an efficient condition, equipped with five sets totalling 14,000 kW. The average peak load had risen from 5,390 kW in 1926 to 5,750 kW last year, while the highest point reached in 1927 was 6,310 kW. At a subsequent extraordinary general meeting, the proposal to accept the offer from the Banque Française et Italienne pour l'Amerique du Sud to take up at par 800,000 7 per cent. preference shares, was adopted.

Stock Exchange Notices.

The Committee has ordered the undermentioned to be officially quoted:—

Anglo-Portuguese Telephone Company.—12,450 shares of £1 each, fully paid, Nos. 400,001 to 412,450.

Kensington and Knightsbridge Electric Lighting Company.—5,500 ordinary shares of £1 each, fully paid, Nos. 312,001 to 317,500.

River Plate Electricity Company.—£67,000 ordinary stock.

Shawinigan Water and Power Company.—70,800 shares of common stock of no par value.

Underground Electric Railways Company of London.—171,172 ordinary shares of £1 each, fully paid, Nos. 5,148,753 to 5,327,924.

Dealings in the following have been specially allowed by the Stock Exchange Committee under Rule 159.

Electrical Finance and Securities.—£90,000 five and a-half per cent. debenture stock.

Underground Electric Railways of London.—23,271 ordinary shares of £1 each, fully paid, Nos. 5,327,925 to 5,351,195.

Calcutta Tramways Co., Ltd

The report for the past year shows a profit of £163,349, as compared with £132,723 in 1926 and £219,044 in 1925. The addition of £12,410 brought forward makes an available sum of £175,759. After meeting debenture intertest, preference dividend, &c., it is proposed to transfer £80,000 to depreciation reserve (against £70,000) and £2,149 to staff provident fund. A dividend of 5 per cent., free of tax, is recommended on the ordinary shares, as for 1926, and £7,758 is carried forward. Meeting: June 5th.

Electric Supply Corporation, Ltd.

The accounts for the past year show a gross revenue of £109,409, as compared with £103,966 in the preceding year; the net revenue was £54,996, against £42,357. With sundry additions, including £5,101 brought forward, the balance available is £61,302. It is proposed to transfer £10,000 to reserve and to pay a final dividend of 6 per cent. and a bonus of 1 per cent. on the ordinary shares, which again makes the total distribution for the year 11 per cent. A balance of £10,525 is carried forward.

A.E.G. Loan in New York.

It was reported last week that the issue in New York of $10,000,000 of 6 per cent. sinking fund gold debentures on behalf of the Allgemeine Elektricitäts Gesellschaft was heavily over-subscribed.

Glenfield & Kennedy, Ltd.

The profit for the year ended March 31st last fell from £59,762 to £43,505. The reserve receives £10,000 (against £20,000), but the dividend remains at 10 per cent., a final distribution of 6 per cent. being recommended.

Shawinigan Water and Power Co.

A dividend of $0.5 per common share has been declared in respect of the quarter ending June 30th.

Western Telegraph Co., Ltd.

The directors have declared the third quarterly interim dividend of 5s. per share, free of tax, for the year ended June 30th.

Stewarts & Lloyds of South Africa, Ltd.

An interim dividend at the rate of 6 per cent. has been declared on the first cumulative preference shares calculated from the due dates of instalments.

Pennsylvania Water and Power Co.

A dividend of $¾ per common share has been declared in respect of the quarter ending June 30th.

Swedish Company.

It is announced that the directors of the Electrolux Company propose to increase the share capital by 54,000,000 kronor to 60,000,000 kronor, of which 6,000,000 would be in bonus shares. The British Foreign and Colonial Corporation, together with Messrs. Higginson, it is stated, would take over 20,000,000 kronor. The proposal will be considered at a meeting of the company on June 30th.—*Reuter* (Stockholm).

Tokio Electric Light Co.

An agreement was reached this week on the issue of a loan for this company on June 7th. The total amount of the issue will be 245,000,000 yen (about £24,500,000). Of this sum it is understood that £4,500 000 will be floated in London, and $70,000,000 (about £14,000,000) in New York for a term of 25 years at 6 per cent., while 60,000,000 yen (about £6,000,000) will be reserved for domestic issue.—*Reuter* (Tokio).

German Company.

The report of the *Felten and Guilleaume Company* states that increasing development took place in 1927, and the turnover was on the level of or greater than that in 1913. Particular mention is made of the construction and laying of a 162-km. loaded telephone cable between Germany and Sweden, the delivery of cables for French towns on reparation account, and the manufacture of part of the Paris-Bordeaux telephone cable. A trial section of a 100,000-V cable was delivered to the Electro-Works Company, in whose network it has been in uninterrupted working for nearly a year. The export business laboured under increasing difficulties, and efforts are being successfully made to meet these difficulties by reorganisation for the extension of markets and the amalgamation of the company's interests with those of foreign consumers.

French Companies.

The *Société Gramme* has declared a dividend for 1927 at the rate of 70 fr. per share out of net profits of 799,000 fr.

The *Compagnie Continentale Edison* reports net profits of 1,880,000 fr. for 1927, against 1,868,000 fr. in the previous year. The dividend remains at 40 fr. per share.

Stocks and Shares.

TUESDAY EVENING.

THE Stock Exchange markets suffered a sharp bout of depression before they resumed a firmer tendency on the eve of the Whitsun holiday. Stock was thrown overboard in fairly large quantities. New York gamblers, who had been heavy bulls of Hydro-Electric and other industrials turned these out by the shovelful, as one colloquial stockbroker put it, and there seemed to be little support forthcoming. The severity of the fall, however, brought bargain-hunters into the markets, with the result that, in the upward reaction, prices recovered most of their previous declines. The Stock Exchange is now passing through what is called a long account: that is to say, one which extends over three weeks, instead of the usual fortnight. These settlements are supposed by tradition to exercise an unfavourable effect upon prices. Business has fallen off to a noticeable extent as compared with what it was a month or two ago, but the appetite for good-class securities is as keen as ever. New issues pour out in a stream so incessant and considerable as to raise a continual question as to whence all the money comes that absorbs the offering of stocks and shares.

Strength in Undergrounds.

One of the outstanding features of strength is a rise in Districts to 76½. Precisely on what grounds this improvement took place, it is difficult to say, because Districts look dear as compared with some of the other stocks included in the Underground list. The group as a whole is very firm, and Metropolitans and the Underground Electric Railways of London stocks are all better. The last-named company announced an offer of £4,000,000 5 per cent. first mortgage debenture stock for sale on Thursday in this week. Holders of the Underground Electric Railway Company's 4½ per cent. bonds of 1933 are having their attention particularly drawn to this new issue, the security for which is good enough to justify expectation of an early closing of the subscription-

lists. A small new issue due almost at once will come from the Greenwich Cable Works, which proposes to create £65,000 7 per cent. mortgage debentures. The brilliant weather which favoured the Whitsun holidays made a bull point for transport shares. Even the hardened Londoner was amazed at the millions of people on the move.

Cable Fluctuations.

Wide fluctuations have occurred in the stocks and shares of the Eastern Cable quartette. Eastern Telegraph ordinary fell to 210 and rallied to 220. The ordinary shares of the Globe, Eastern Extension, and Western Telegraph Companies, now up to 21½, have been down to 21. In defence of the advance, it is said that the arrangements for some kind of co-operative working between the cable, the wireless and the beam systems are still under consideration, in spite of the chilling reception given to the project by the Labour party in Parliament at the beginning of last week. The attitude of Labour, indeed, appeared to be hostile to the linking-up proposal, but in spite of that, the impression is prevalent that negotiations will continue, and that, in course of time, some kind of agreement will be reached. The optimists maintain that Marconis are demonstrably cheap, with anything of this nature in view. The ordinary shares have remained firm at 3¼, and the debentures, after dropping to 150, recovered to 180. There has been a large volume of business in all the Marconi issues.

Bournemouth and Poole Electric.

Amongst electricity supply shares, the main movement is a gain of about 7s. in Bournemouth & Poole ordinary. This raised the price to 2¾ ex dividend. It may be remembered that a hint was thrown out here, earlier in the month, as to the possibility of the recent bonus being by no means the full explanation of this year's dramatic rise in the price of the shares. "You can't have your cake and eat it too," is declared, and in responsible quarters, to be inapplicable to holders of Bournemouth & Poole shares. There is also a steady demand for shares in the London electricity supply companies. City Lights are better at 28s. 6d. County of London, on the other hand, have drooped a trifle. Clyde Valleys, of the power undertakings, added 1s. 6d., at 37s. 6d., to their rise of last week. Midlands Counties remain the focus of lively dealing, but show no change, on balance, at 30s. The Electric Supply Corporation repeats its last year's dividend of 6 per cent., making 10 per cent. for the year and 1 per cent. bonus. No change has taken place in the previous price of the shares at 52s. 6d., at which the yield on the money comes to a trifle over 4¼ per cent., allowing for inclusion of the dividend in the price.

Transport Issues.

The line of London General Omnibus 5 per cent. income debenture stock that was on offer early in May at 97¾ free of the 1 per cent. Government transfer stamp, has all been placed, and the price is now 98 for what is called stamp stock. London United Tramway 4 per cent. debenture is 2 points up at 62½; the preference shares stand at 8s. 9d. No recovery has happened in London & Suburban Traction shares, dull at 10s. 6d. sellers, the ordinary being about 3s. 1¼d. British Electric Traction, at 530 middle, is 10 points up: stock changed hands last week at 535. In the foreign divisions, Brazilian Tractions are weak at 60½, equivalent to 242 for the shares in their unsplit shape. Calcutta Tramways are steady at 20s. The report shows a moderate increase in earnings, and the company will again pay 5 per cent. tax-free on the ordinary shares. The report shows that improvement in the tramway takings has been offset by loss on the omnibus service. The Mexican Utility issues are inclined to give way, Mexican Light and Power common shares being 2 down at 92¼. Mexico Tramways declined to 41½. Amongst the Canadian Utilities, Montreal Light and Power common lost 5, at 106. The speculative fever has been running very high in the United States and the Canadian exchanges, with the result that a weak bull account is probably existent, and this may tend to depress prices until strong hands gain command of the market. Hydro-Electrics are dull at 78. International Holdings keep good at 330.

Manufacturing and Miscellaneous.

Prices of the manufacturing companies' shares are a trifle irregular. The principal feature of strength is a rise of 7s. 6d. in Henley's, which has taken the price to £6 per share, and is due to the hope that the dividend of 25 per cent. will either be increased, or will be accompanied by the announcement of another bonus. Amongst the lower-priced shares, Edison Swan are better at 12s. 6d., showing a gain of 2s. 6d. Brush ordinary are better at 28s. 9d. On the other hand, Metropolitan-Vickers ordinary declined to 30s., and Enfield Cable preference are lower at 25s. The iron and steel market is steady; Armstrongs have fallen upon quiet days, and there is no alteration in Babcock & Wilcox at 67s. 6d.

Amongst rubber shares, the tendency is better, thanks to a modest improvement in the price of the product, and to the fact that there has been a little buying, which came upon a market not too well supplied with a floating supply of shares. A substantial new issue of Tokio Electric Light Company 6 per cent. bonds is projected. London's share is expected to be about 4½ million pounds sterling and it is thought that New York will take a further 70 million dollars of the same loan.

Share List of Electrical Companies.

	Nom.	Dividend. 1926.	Dividend. 1927.	Price May 29, 1928.	Rise or fall.	Yield. p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	£ 1	14†	15½	2¾xd	+7/-	... ...
Brompton Ordinary	1	8½	8½	25/6	—	5 9 10
Charing Cross Ordinary	1	8½	8½	27/-	—	5 3 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8½	8½	26/6	—	5 5 8
City of London	1	10	10	29/6	+6d.	4 16 8
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	37/6	+1/6	4 5 4
County of London	1	7½	7½	37/6	—6d.	4 0 0
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundsons' 7% Pref.	1	7	7	25/6	—	5 9 10
Elec. Supply Corporation	1	11	11	52/6	—	4 3 10
Kensington Ordinary	1	8	8	26/6	—	5 5 8
Lancs. Light and Power	1	7½	7½	29/6xd	—	5 1 8
London Electric	1	8½	8½	26/6	—	5 10
do. do. 6% Pref.	5	6	6	5½	—	5 8 2
Metropolitan	1	8	9	2¾	—	3 15 9
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6	6½	30/-	—	4 6 8
Newcastle-on-Tyne Ordinary ...	1	5	6	27/6	—	4 6 8
do. 5% Pref. ...	1	5	5	19/6	—	5 2 7
do. 7% Pref. ...	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	10½	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	5	8	8	27/-	—	5 3 8
South London	1	8½	8½	26/6	—	5 5 8
South Metropolitan Pref.	1	7	7	1¼	—	6 8 0
Urban Ordinary	1	7	7	51/3xd	—	2 14 7
do. 6% Pref.	1	6	6	1¼	—	5 6 8
Westminster Ordinary	1	8½	8½	27/-	—	5 3 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	23/3	—	6 9 0
Yorkshire Elec.	1	8	8	33/-	—	4 17 0
HOME RAILS.						
Central London Ord. Assented ...	Stock	4	4	71	—	5 12 8
Metropolitan	,,	3	3	69½	+½	4 7 4
do. District	,,	3½	4	76½	+2	5 4 7
Underground Electric	£1	1½	5	26/6	—	3 15 6
do. do. Income ...	Bonds	6	6	126	+1	4 15 3
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	100½	—	5 19 5
do Def.	,,	1½	1½	24¼	—	6 3 9
Automatic Telephone	1	10	10	45/-	—	4 9 0
Eastern Extension	10	10	10	21½	—1	*4 13 0
Eastern Tel. Ord.	Stock	10	10	220	—5	*4 11 0
Globe Tel. and T. Ord.	10	10	10	21¾	—¾	*4 13 8
do. do. Pref.	10	6	6	11½	—	5 7 10
Great Northern Tel.	10	20	20	41½	—	4 16 5
Indo-European	25	10	10	42½	—	*5 17 8
Marconi	10/-	5	—	65/-	—	0 15 6
Marconi-Marine	1	8¾	12½	50/-	—	5 0 0
Oriental Telephone Ord.	1	12	12	52/6	—7/8	*4 9 8
United R. Plate Tel.	5	8	8	11-7/8	—¾	*8 11
Western Telegraph	10	10	10	21½	—1	*4 13
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref. ...	5	5½	5½	8½	—	7 4 8
do. do. 2nd Pref. ...	5	6	6	8½	—	7 17 4
do. do. 5% Deb. ...	Stock	5	5	76¼xd	—	6 11 2
British Electric Traction Def. Ord.	,,	—	—	530	+10	... ...
do. do. 8% Pref. Ord.	,,	8	7½	124½	—	6 8 6
Brazil Traction	100	6	7	60½	—3	2 17 10
Brit. Columbia Elec. Rly. Pcc. ...	Stock	5	5	94½	—	5 5 9
do. do. Preferred ...	,,	6½	6½	268	—	*2 6 9
do. do. Deferred ...	,,	8	8	307	—	*2 12 1
do. do. Deb.... ...	,,	4½	4½	86½	—1	4 18 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	10/6	—	... ...
London United Tram Deb. ...	Stock	4	4	62½	+2	6 8 0
Mexico Trams, 5% Bonds	—	5	5	88½	—1½	5 13 0
Mexican Light Common	100	Nil	Nil	92½	—2	... ...
do. 7% Pref....	100	Nil	7	84½	—	8 5 8
do. 1st Bonds	—	5	5	88½	—	5 19 9
Yorkshire (West Riding)	1	Nil	Nil	7/6	—	... ...
MANUFACTURING COMPANIES.						
Babcock & Wilcox	1	18	15	67/6	—	*4 9 0
British Aluminium Ord.	1	10	10	47/-	—	*4 5 1
British Elec. Transformer Pref. ...	1	7	7	18/-	—	7 15 7
British Insulated Ord.	1	15	15	4¾	—	3 13 0
Brush Ord.	1	10	10	28/9	+6d.	6 19 0
Callenders	1	15	—	4¾	—	3 10 9
do. 6½% Pref.	1	6½	6½	23/-	—	5 9 5
Crompton Parkinson Pref. Ord. ...	1	—	—	17/6	—	... ...
do. 8% Pref.	1	—	8	25/-	—	6 8 0
Edison-Swan	4/-	10	10	12/6	+¾	3 4 0
do. 5% Deb.	Stock	5	5	90	—	5 11 0
Electric Construction	1	7½	—	31/3	—	4 16 0
Enfield Cable Pref.	1	7½	7½	25/-	—7/8	6 0 0
English Electric	1	Nil	Nil	8/9	—	... ...
do. do. Pref.	1	8	Nil	11/3	—	... ...
Gen. Elec. Pref.	1	6½	6½	25/-	—	5 4 4
do. Ord.	1	7½	—	37/-	—2/6	3 16 0
Henley	1	25	—	6	+£	4 3 4
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	Nil	Nil	13/9	—	... ...
Johnson & Phillips	1	12½	10	43/9	—	4 11 4
Met.-Vickers Ord.	1	8	6	1¼	—1/8	4 0 0
do. Pref.	2	8	8	2£	—	6 1 11
Siemens Ord.	1	7½	7½	23/9xd	—	5 4 4
Telegraph Construction	12	10	10	26½	—	*4 10 11

* Dividends paid free of Income Tax.
† 4% of which was Tax Free

A Report on the Electrical Industry.

A Survey by the Balfour Committee.

(*Concluded from page 922.*)

THE concluding chapter of the electrical section of the Report deals with the world market and international competition. After a brief review of electrical development in various parts of the world, attention is given to the leading electrical manufacturing countries. The United States and Germany are Great Britain's chief competitors in the international market, but France is growing in importance as an exporter of electrical goods, and other countries have to be reckoned with. The value of electrical production in the United States rose from $359 million in 1914 to $1,654 million in 1925. Between 1913 and 1925 the value of Germany's output of electrical machinery and apparatus rose from 65 to 105 millions sterling, according to a B.E.A.M.A estimate, while the same authority gives the rise in value of the French output as from £7,700,000 in 1913 to £21,000,000 in 1925. The electrical industry of Germany is comparable in size to, although larger than, that of the United Kingdom, while that of the United States is on a considerably larger scale. In all the manufacturing countries alike, however, the industry is dominated by the large concern. The increasing tendency to the use of larger generating units restricts competition to the larger companies; in the lighter branches of the industry competition is intense.

In the United States three companies stand out prominently: the General Electric Co., the Westinghouse Electric and Manufacturing Co., and the Western Electric Co. (now the International Standard Electric Corporation). In 1916 these three companies were credited with 60 per cent. of the total output of the American electrical manufacturing industry, valued at $500 million. In 1926 the General Electric Co. claimed to contribute 22 per cent. of the total output, and the Westinghouse Co. 11 per cent. The large American concerns spend considerable sums upon research.

The electrical export trade of Germany is in the hands of a few concerns with immense resources, highly-trained staffs, well-equipped factories and research laboratories, &c. Branches have been established all over the world, and close connections are maintained with leading Continental financial institutions. The Allgemeine Elektricitäts Gesellschaft is said to employ 75,000 workpeople, and the Siemens & Halske and Siemens-Schuckert companies have 112,000 workpeople. Some control over the market for electrical machinery has been obtained by participation in the financing of electric power developments, but this activity has been somewhat limited in recent years by the formation of large power supply undertakings with their own financial affiliations.

The French manufacturing industry is closely associated with supply undertakings, and is thus assured of a permanent market for its products. The industry is dominated by a few important concerns which have extensive ramifications in the way of associations and connections with other manufacturing and distributing concerns. The electrical manufacturing industries of Switzerland, Sweden, Austria and Italy are on a smaller scale. Owing to their small home market, Swiss manufacturers have been compelled to concentrate on foreign business, and associations with power-financing concerns have enabled them to secure some preference for their plant. The Austrian industry employed about 20,000 people at the beginning of 1927, when the works were employed to about 60 per cent. only of their capacity. Swedish exports and imports of electrical goods are comparable in value, although exports comprise a considerable proportion of the output. The importance of the Netherlands electrical industry is based mainly on lamp production, in which the Philips concern is the leader.

The export trade of Canada is substantially equal to that of Italy, and consists mainly of insulated copper wire and cable, vacuum cleaners, sparking plugs, magnetos, telegraph and telephone apparatus, domestic appliances, &c. A table shows that the capital employed in the Canadian electrical industry rose from $69 million in 1920 to $80 million in 1926, and the selling value of products from $56 to $70 million. The Japanese electrical industry developed rapidly during the war, and at the end of 1924 it was stated to have a capital of £12,000,000, and to employ 36,000 persons.

Brief reference is made to some of the international connections between electrical firms as an indication of the nature of the relations which have been established. The volume of international trade is then dealt with. A table shows the amount of imports and exports of the leading electrical manufacturing countries, and gives the differences. From this it is seen that in 1913 Great Britain's excess of exports over imports was £5,061,000; by 1926 it had risen to £14,499,000. During the same period the United States' balance rose from £5,346,000 to £18,401,000, while that of Germany increased from £15,225,000 to £17,740,000. Adverse balances were shown by Italy, Japan and Canada both in 1913 and in 1926. The United Kingdom is pre-eminently the leading importer of electrical goods, besides being the principal exporting country.

The next table gives the total exports of the United Kingdom, the United States, Germany, France, Switzerland and Sweden for five separate years, and shows the proportion provided by each country in each year. The total for 1913 was £32,541,000, and from 1923 to 1926 it rose in stages from £50,217,000 to £66,113,000. In the pre-war year, Germany was responsible for nearly half the total (48.97 per cent.), while Great Britain accounted for 23.53 per cent., the United States 17.10 per cent., France 4.54 per cent., Switzerland 3.72 per cent., and Sweden 2.14 per cent. From 1923 to 1926 the three leading companies each supplied a proportion in the neighbourhood of 30 per cent.; Germany headed the list in 1923, the United States in 1924, and Great Britain in 1925 and 1926. The shares of the other three countries in the period 1923-26 were higher than before the war, and remained fairly constant. The position disclosed is that while Great Britain's share has slightly increased since the war, the United States has benefited at the expense of Germany.

A broad analysis is made of the destinations of electrical goods from Great Britain, the United States and Germany. An outstanding feature of this is the importance to Great Britain of the Empire markets; they now take a higher proportion of the electrical exports than before the war. The markets of the German exporter lie mainly in Europe. As regards the electrical exports of the United States, about one-third is taken by the British Empire (chiefly by Canada and Australia), but this proportion is smaller than was taken before the war. The proportion consigned to Europe and to Japan has increased materially, and Central and South America are markets of importance. The rise of American exports to Europe since the war has been remarkable. While the German share remained practically stationary in 1925 as compared with 1913 (between £11 and £12 million), and that of the United Kingdom rose from £915,000 to £3,076,000 (due to a large export item of submarine cable), the United States increased its share from £617,000 to £3,240,000. Great Britain is the largest European customer for both American and German electrical products; the respective averages for the three-year period 1923-25 were £1,179,000 and £1,231,000. In every leading European country except France, Germany supplied a greater quantity of electrical goods than did Great Britain. Italy and France were our principal customers, with Spain and Russia third and fourth. It is of interest to note that the respective shares of the Russian import trade in the three-year period were: Great Britain £225,000, United States £40,000, and Germany £470,000.

So far as the British Empire is concerned, in all cases, except Canada, the proportion of the electrical imports supplied by the United Kingdom is considerable. The decline in the German share of the markets has benefited both the United Kingdom and the United States in Australia, but in New Zealand the benefit has fallen mainly to the United States, and in South Africa it has been secured principally by the United Kingdom. In India the Germans have substantially recovered their pre-war position, while the United States manufacturers have improved their position in all the markets.

From a comparison of the pre-war and post-war positions of the electrical import trade of Argentina and Chile it is seen that the United States' share has grown considerably, largely at the expense of Germany. While the United Kingdom has improved its position in Chile, it has relatively lost ground in Argentina. The United States has maintained its dominance of the Brazilian market; the United Kingdom's share is smaller, while that of Germany, higher in 1923 and 1924 than before the war, fell in 1925 to about pre-war level. Both Germany's and the United Kingdom's shares of Mexican and Cuban trade have remained small compared with the volume provided by the United States.

Both Japanese and Chinese electrical imports have grown considerably since the war. The Chinese total rose from £477,000 in 1913 to £1,758,000 in 1926. The proportion supplied by Great Britain fell during this period from 27.1 to 16.0 per cent., and that supplied by Germany from 33.9 to 19.7 per cent. At the same time the Japanese exports to China increased from 15.2 to 32.6 per cent., and the American proportion from 6.3 to 13.2 per cent. The United Kingdom supplies the largest proportion of electrical goods imported into China by way of Hong Kong; the total value recorded in 1924 was £117,000. Although Japan has developed considerably in the production of electrical goods, that country's imports of electrical machinery and apparatus rose from £733,000 in 1913 to £3,003,000 in 1924; they declined after that year, and were valued at £2,337,000 in 1926. In this market the United States has benefited very considerably at the expense of Germany, while Great Britain's share has declined to some extent. The analysis shows that in 1913 the three countries' shares were as follows:—United Kingdom 23.0 per cent., Germany 46.4 per cent., and the United States 28.5 per cent. In 1926 their respective shares were 26.6 per cent., 21.8 per cent., and 51.7 per cent.

Electricity Charges in Wandsworth.

The Minister of Transport's Inquiry.

BY direction of the Minister of Transport, an inquiry was held at the Town Hall, Wandsworth, on May 24th by Sir Harry Haward and Mr. W. W. Lackie, two of the Electricity Commissioners, into the application of the Wandsworth Borough Council and six South London Chambers of Commerce and Ratepayers' Associations, the latter representing the consumers, for a revision of the maximum charges and methods of charge made for electricity supply by the County of London Electric Supply Co., Ltd., under the Wandsworth Electric Lighting Order, 1892. Mr. J. D. Cassels, K.C., and Mr. E. J. Rimmer appeared for the Borough Council, Mr. B. Mackay Cloutman was counsel for the consumers, and Mr. W. Craig Henderson, K.C., and Mr. S. Turner represented the Company.

After Mr. Henderson had pointed out that the Borough Council had not conformed to the statutory requirements in the method of its application, Mr. Cloutman opened the case for the consumer applicants. Remarking that the maximum charge allowed had stood at a figure of 8d. per unit for the last 36 years, he submitted that the published figures of the Company's output and financial returns warranted a reduction of the maximum price to 4d. per unit. He would deal with the first part of the consumers' case for the reduction under three heads—the dividends paid by the Company, the amounts placed to reserve, and the annual "carry forward"—basing his remarks on the Company's reports for 1925 and 1927, and leaving the question of the methods of charging until later. After mentioning the dividends that had been paid, he pointed out that while in 1925 the total expenditure of the Company was £408,760, the available surplus was no less than £915,621. Throughout the whole of the country there was no other company, working under a similar monopoly, that enjoyed anything like this position. In that year the Company, after putting £150,000 to reserve and after making liberal provision for depreciation and contingencies, had set aside for general reserve a sum of £335,000. This vast amount of money was equivalent to 3.2d. per unit on the price of electricity, and had it been used to relieve the private consumer, the price charged might have been reduced by that amount; in other words, even in 1925 a maximum of 4d. would not have been an unreasonable figure. Counsel agreed that the Company had not distributed a penny more to its shareholders than it was entitled to do under the various Acts; he, however, emphasised that from the year 1921 to 1925—that was the period when legislation intended to protect the consumers was being framed—the Company was building up vast reserves from surplus revenue at the rate of about one-third of a million sterling per annum, the reserves having increased from £107,000 in 1920 to £1,335,000 in 1925, which in that year was distributed as bonus to the shareholders to an extent which represented 133 per cent. on their holdings. He claimed that the Court, in considering the revision of the maximum price, should not regard the 7 per cent. per annum which had to be found out of the revenue as dividend on the capitalised reserves to be part of the reasonable margin between costs and revenue provided for in the Acts.

Since the distribution of the bonus shares, the amount set aside for reserves had again begun to increase rapidly, having jumped from £224,654 in 1926 to £321,785 in 1927. The recent history of the Company, counsel submitted, warranted the Court in scrutinising the reserves very closely in considering the question of maximum price. Counsel then drew attention to the fact that not only were reserves allotments being increased, but the amount carried forward each year was steadily advancing, last year's "carry forward" being roundly £150,000 more than that of 1926. Thus, in making recommendations to the Minister, the Court should have regard to three things: the dividends paid by the Company, the reserves, and the carry-forward.

Counsel next proceeded to deal with the production costs of the Company, which, he showed, had declined from 0.741d. per kWh in 1924 to 0.406d. in 1927, while the total cost of generation and all overhead charges had fallen from 1.153d. to 0.677d. in the same period, the reduction in both cases being about one-third. The Company's output last year had amounted to 248 million kWh, 134 millions of which were supplied in bulk to other undertakers at an average of 0.55d. per unit. The Company had made an offer to Barnes to give it a bulk supply at 0.5d. per unit. If the Wandsworth Borough Council were in a position to undertake the distribution and had the same offer, it would be able to supply electricity to private consumers at 4d. per unit or less, whereas the rate charged by the Company last year was 7.15d., since reduced to 6½d. In conclusion, Mr. Cloutman remarked that he did not intend to call any witnesses to give evidence, submitting that the disclosed figures of the Company were sufficient support for the applicants' claim for a reduction of the maximum charge to 4d. per unit, and so to protect the consumers from a repetition of the financial events of 1925. Just as the Company and its shareholders were entitled to justice, so also, he submitted, were the consumers.

Mr. CASSELS, for the Borough Council, spoke of the intensity of the feeling against the charges made for electricity supply in the Wandsworth area, referring to the town's protest meeting held in February last. He also made comparisons between the prices charged in Wandsworth and the lower rates prevailing in Barnes, Battersea, Fulham, and other adjacent areas. Wandsworth consumers had to pay more than the average charged by the Company. "We support the case as set forth," added Mr. Cassels, "because we feel that it is a strong case and because Wandsworth electricity consumers are suffering under heavy burdens which, in view of the financial position of the Supply Co., should be lifted from their shoulders." With regard to the actual charges for supply in contradistinction to the maximum charge, he suggested that a conference between the Council and the Company might be useful, and that in the meantime the present inquiry might be adjourned. He added that there was every prospect of the standard price ruling the sliding scale of dividends under the 1925 Act being settled in the near future.

Mr. HENDERSON, in his reply for the Company, said that although it was suggested that the Company could afford to charge less for its supplies, that was outside the scope of the inquiry, and was consequently not the matter at issue. As to the distribution of the reserves, the Company for years had invested a large part of its profits in its own undertaking. There were assets representing the full value of the capital. They had capitalised their reserves to pay for extensions, and it was idle to say that this money should have been given away in reduction of prices. He next referred to the Acts of Parliament under which supply companies now operated, and added: "If you fix 4d. as a maximum price, as is suggested, the Act of 1925 will go into the fire." Reference had been made to the standard price which had been under discussion between the Company and the London County Council, but the figure suggested by the Company as the standard could not operate if the maximum was to be fixed at 4d.

Continuing, counsel remarked that the Barking station, which cost 5½ millions, although not yet fully developed, had enabled costs to be brought down. Except for the capitalisation of reserves, additional money for Barking would have had to be borrowed. As to the carry-forwards, these had been less than those allowed by the Act of Parliament. Moreover, this year the Company was giving away in reduced prices £158,000, which was more than the total increase in the last carry-forward. Again, it was a mistake to assert that all the reserves came out of the pockets of consumers. Large sums came from the Company's investments.

Mr. CASSELS: "Where did the money for the investments come from?"

The chairman (Sir HARRY HAWARD): "I should also like to know where the money came from to make these investments."

In reply, Mr. HENDERSON said that it came partly from the profits and partly from the "investment reserve account."

In conclusion, Mr. HENDERSON stated that he was authorised to say that if the Wandsworth local authority desired to meet the County of London Co. in order to discuss its proposals, the Company and its chairman were perfectly agreeable. They had been at work for a long time past on a two-part or multi-part scheme of charges for the borough that should benefit the consumer, and they hoped to have it finished in three or four months and to have it ready for work by the end of the year. Finally, he repeated that the only question before the Court was that of the revision of the maximum price, and argued that no evidence had been brought forward to justify any such revision. Under the circumstances he did not propose to call any witnesses.

Mr. CLOUTMAN then rose to deal with the second part of the inquiry—that relating to the methods of charging. Mr. HENDERSON raised an objection, pointing out that "methods of charging" was not included in the consumers' application, which referred only to the revision of the maximum charge. Mr. CLOUTMAN, however, read the letter from the Minister of Transport announcing his decision to order an inquiry into "the maximum charge and the methods of charge." The question of the scope of the inquiry was discussed for some time between the counsel and the Chairman, finally, after consultation with his colleague, Sir HARRY HAWARD announced that the position of the Commissioners was somewhat difficult in view of the fact that no witnesses had been called on either side. They would therefore like a further opportunity of considering the position, and under the circumstances would adjourn the inquiry to some date to be settled hereafter. In the meantime there would be an opportunity for a meeting to take place between the Company and the consumers, as had been suggested.

Mr. HENDERSON, in opposing the proposal for adjournment, stated that the Company would prefer to deal with a representative body like the Borough Council rather than with a group of consumers.

Sir HARRY HAWARD: "It is surely necessary for the Company so far as possible to work in harmony with their consumers."

The inquiry then stood adjourned.

A Railway Overhaul Works.

Some notes on the electrical equipment at the extended and modernised Acton works of the London Underground Railways.

ON Tuesday last week, at the invitation of the London Underground Railways, a number of Press representatives visited the overhaul works of the companies at Acton. Since our last visit to these works a few years ago (ELECTRICAL REVIEW, March 7th, 1924, p. 379) it has been found necessary to extend and reorganise the departments in order to allow of the complete overhaul of about 30 cars per week.

The main feature of the reorganisation is a new system of progression which has been adopted. This provides for the dismantling and reassembling of the bogies and car-body equipment, car painting, and a large amount of work in the various repair sections being carried out under continuous movement. Electrically operated conveyors are installed in the bogie and car-body shops for this purpose, and these are claimed to be the first continuously moving conveyors installed to accommodate railway rolling stock in the world.

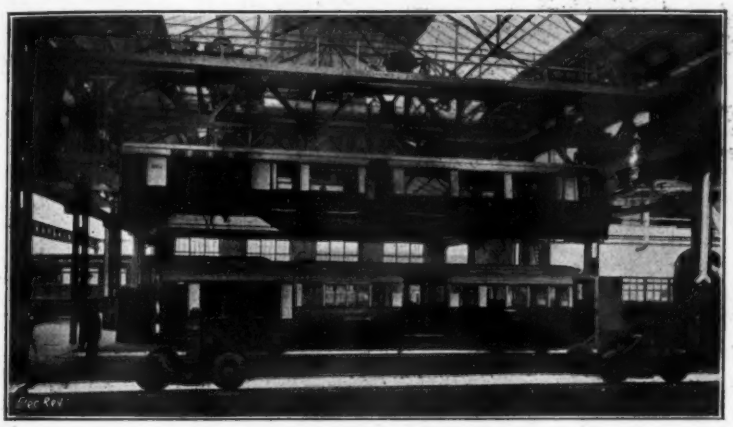


Fig. 1.—Special 30-ton Car-lifting Crane.

In the paint shop and certain other places where disintegration of the unit is not involved, electrically operated endless chains are used as the means of haulage, the movement being continuous.

There are five main departments, namely, the lifting, truck, body, paint and wood shops. The main building, accommodating the truck, body and paint shops, measures 400 ft. long by 375 ft. wide.

Car-lifting is carried out by means of a 65-ft. span 30-ton duplex crane of special design, fig. 1, so arranged that the two grabs can either be used independently or coupled together. When coupled they are controlled from one handle, and the lifting speeds are synchronised regardless of any variation in load distribution. The run of this crane covers the dismounting, mounting and general-repair sections. Movement of the bogies and car bodies from the lifting shop to the truck and body shops, and *vice-versa*, is provided for by means of electrically driven haulage chains, transverse movement being accomplished by means of 45-ton electrical traversers.

From the electrical point of view the truck shop is the most interesting, and some special and unusual machines are to be found in this section. The shop is equipped with two electrically operated conveyors, one for dismantling and the other for assembling the bogies. These conveyors travel at seven in. per min. in opposite directions, the dismantling conveyor being placed at one side of the shop and the assembling apparatus at the other; various repair sections are situated between the two conveyors and placed in the order in which the parts are dismantled and reassembled. The dismantling and assembling of the bogies are facilitated by means of 3-ton electric travelling cranes and fixed lifting tackle at appropriate positions. An armature section is fully equipped for carrying out general repairs, including complete rebuilding or rewinding. The plant is arranged in the order of the sequence of operations.

A separate section serves for the overhaul of motor-cases, including field coils, brush gear, frameheads, armature and suspension bearings, and is fitted with special apparatus for washing frameheads and bearings, blowing out the cases, milling the suspension bearing seats, and so on. In the section provided for dealing with repairs to truck frames, the work is carried out on a conveyor moving at a speed of 10 in. per min. Space is provided at one side of the conveyor for dealing with work of an unusually heavy character; and a 5-ton overhead travelling crane covers the whole area. This section is equipped with electric rivet heaters and electric welding plant. An interesting feature of the equipment is a magnetic device in the wheel and axle section for detecting flaws in axles. The axle is magnetised and bathed with a special "ink" or solution containing iron filings. These build up over any crack in the metal (ELECTRICAL REVIEW, August 27th, 1926, p. 337). After this examination the wheels are distributed, by means of an electric transporter designed and built at Acton, to storage tracks adjacent to the appropriate plant dealing with the operation to be carried out, and are finally delivered to the bogie assembling conveyor. The plant in this section includes tire-boring mills of the most modern design, each equipped with its own pneumatic hoist. Fig. 2 shows a duplex machine which serves for both rough grinding and finishing. Specially designed electric induction heaters employed in connection with the shrinking-on of tires form a feature of the equipment in this section. There are also wheel lathes of the most powerful centre-drive type, fig. 3, driven by 50-h.p. motors and equipped with patent pneumatic turret-type tool holders and with headstocks moved by electric power and locked by pneumatic means. These lathes are capable of taking ½-in. cuts with a fed range from ¼ in. to ½ in. traverse per revolution of the faceplate, and a cutting speed of 10 to 30 per min. Independent electric hoists running on an overhead gravity runway are provided for each machine.

The general arrangement of the body shop is similar to that of the truck shop, there being a dismantling road down one side and an assembling road on the opposite side, with the repair sections placed in the sequence of operations in the centre between these two roads. All the cars entering this section are subjected to a high-pressure test to detect faults in the various circuits, this work being carried out in a railed-off enclosure before the car is attached to the dismantling-road chain. Two overhead electric cranes are used to remove the compressors from the cars and to replace them after overhaul. The electrical equipment section is provided with storage racks on the dismantling side to receive the various items of equipment as they are dismantled from the cars, repair benches in

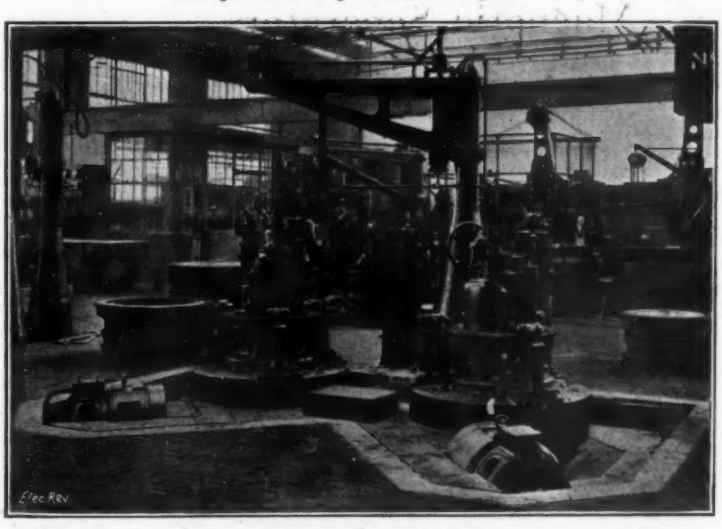


Fig. 2.—Duplex Tire-boring Mill.

the centre, and storage bins on the assembling conveyor side to receive the overhauled units. Each bench is equipped with an electric motor mounted on a swivelling pedestal and driving a flexible shaft to which can be attached various labour-saving tools used in connection with the operations in hand. Bench grinders, finishers and drills are also provided.

The paint shop is equipped with three tracks, each provided with an electrically driven endless train. Two roads provide for touching-up and varnishing, and on these the work is done under movement, the cars moving forward continuously at a speed of 3 in. per min. The third road is set apart for repainting, and here movement is intermittent, the cars being moved at fixed intervals by means of the chain which runs at 30 ft. per min.

Fig. 3.—Heavy Car-Wheel Lathes.

In the wood shop the benches and car positions are equipped with electrically driven flexible shafts to which can be attached labour-saving tools, the motors being suspended on overhead runways.

Direct current is used throughout the works for the motive power, and is taken from the Acton Town sub-station of the District Railway; alternating current is used for lighting and for certain special purposes, such as tire-heating, rivet- and pipe-heating, and is obtained from the transformer house of the Chiswick Works of the London General Omnibus Co., Ltd.

Magnetic Separators.

A Comparative Review of the Different Types of Machines in Vogue.

A PRACTICAL and instructive address on modern developments in magnetic separators was given at a meeting of the Birmingham Electric Club on April 27th by Mr. Wm. Edward Box. Magnetic material, the lecturer pointed out, was naturally more easily dealt with when it was in a free state than when it was not; much depended upon the permeability, size, and shape of the material to be extracted, and upon the time during which it would remain under the influence of the magnetic field.

When treating difficult classes of material, it was sometimes necessary, particularly if the magnetic product were only feebly susceptible to magnetism, to utilise a magnetic separator of high intensity: but if the material were highly susceptible, then a separator of low intensity could be used. It was also frequently necessary to treat a second or even a third time, when the mechanical difficulties were multiplied. There had been many experiments in the winding of separators for a.c. supply, but, in addition to proving more costly, their magnetic efficiency was never so good, and the response with laminated fields was sluggish.

Most of the disadvantages of the earlier stationary suspension types of separators, such as insufficiency of attraction for small pieces of iron covered by non-magnetic material, and the necessity for suspension clear of the flow and the consequent diminution of power, interruptions of the circuit due to the blowing of fuses, &c., were overcome by a separator in the form of a chute, which was generally placed at an angle so that the material under treatment passed down by gravity. This method was effective only where the iron content was small. The apparatus was fitted with an automatic electrically operated device which provided that, if the current failed, the iron would be released and diverted into a suitable receptacle.

The lecturer described a separator trough for dealing with liquids such as potters' slip. Foreign material in the form of iron or iron oxides was dangerous in the manufacture of gun-cotton, he observed, and the presence of specks in finished china, earthenware or paper was very objectionable. Further, if iron particles were left in insulating material, its dielectric strength might be decreased by a very considerable degree. Dark brown and yellow specks in china could be traced in ball clay and fire clay in the first instance, and for the extraction of them such leading firms as the Royal Worcestershire Porcelain Co., Wedgwoods, Doultons, Crown Derby, and Aynes.eys & Hudsons utilised magnetic separators. The black speck was true iron, very permeable, and the yellow and brown specks were iron oxides, pyrites and sulphides, much less permeable and more difficult to extract. The magnetic trough employed had to be watertight, as it dealt with the material in a wet state. The magnetic bars consisted of castings of Swedish iron, having a number of projections with sharp vertical edges for obstructing the flow and ensuring a constant frictional contact for the liquid. A constant feed could easily be arranged by a suitable arrangement of a baffling box fitted with walls. This and similar types of separators were very economical to run, the loading for a 12-in. trough being only about 250 kW, and the cost of the current, therefore, about ¼d. per hour for the treatment of 1¼ tons of wet material.

The screen-type separator was another important member of the first group. The chief application of this type was for the extraction of iron for its value from shipyard refuse, foundry sand, and raw house refuse. The problem of dealing with house refuse still appeared to be somewhat controversial, but it was clear that if the final product was clinker, it must, if it were to be of maximum value as road material, be free from iron. The first application of the screen separator for the treatment of house refuse was due to the foresight of the Birmingham Public Salvage Department. The latest types of screen separators weighed nearly two tons, and were capable of dealing with 15 tons per hour, with a consumption of about 2.2 kW.

The jig shaker type of separator consisted of a magnetic trough as previously described, but it was sometimes necessary, when treating material of a sticky nature, to aid its flow over the magnetic bars. The machine comprised a framework to which was fitted a magnetic chute located in a cradle, provided with a device for adjusting the angle of repose. In this cradle was mounted the magnetic trough. This was jig-shaken laterally at about 250 per min., and the material cascaded over the bars, thus giving many chances for the iron to be extracted.

Such machines were particularly suitable for the treatment of certain ores, gun-cotton, paper pulp, oils, dry cocoa, and other powders, tea, brass, and similar turnings, and so on. There were many different types of rotary self-discharge separators, some of which were used to protect pulverisers and grinding machines, from tramp iron in the form of nuts and bolts, pick-heads, &c. A well-known type was the conveyor magnetic pulley, in which the pulley consisted of a machined high-permeability steel casting on the core of which was placed a number of coils, flat and circular in shape, having circular extended bosses which acted as cores. In the drum pattern of rotary separator, the magnetic unit was of the half-moon pattern and was stationary, with a non-magnetic drum revolving about it. This class had been developed for existing plants where there was little room for other applications.

In the fourth group there was one special high-intensity electromagnetic separator which was used for the treatment of feebly magnetic ores. This machine was capable of separating a material into six different parts, according to the permeability of each. It consisted of a framework, stationary magnetic unit, belt conveyor, and revolving disk. The method of feed varied according to the material under treatment, but this type of separator was suitable for the separation of wolfram tin, wolfram bismuth, monazite sand, zinc blende, and any kind of ore amenable to separation. In the miscellaneous group there was also a magnetic rake, similar to an ordinary sweeping broom, but with magnetic prongs in place of the bristles, and this type was used for the extraction of iron spread over the floor.

The Belgian Electrical Industry.

Official statistics relating to the Belgian electrical industry during 1926 show that at the close of the year the total capital employed was 1,500 million francs and the number of employés about 35,000. The total value of the production during 1926 was 900 million fr. and of this over half (valued at 470 million francs) was exported.

Steam Boiler Water Treatment.

A non-chemical method of preventing the accumulation of scale in water-circulating systems by the employment of true colloids, which, it is claimed, will even enable sea water to be used for making-up boiler feed water.

By A. T. RIDOUT.

(*Extracts from a Paper read before the* INSTITUTE OF MARINE ENGINEERS.)

THE method described of treating water is physical, as distinct from chemical means, and utilises colloids. There are many boiler fluids on the market which are in reality chemicals, although they may be called colloids. A colloidal solution may be described as having a substance in it whose particles do not deposit or settle out, the particles being so finely divided that their mutual attraction is sufficient to overcome gravity.

Crystalloids, which are the opposite of colloids, in solution will pass through a parchment filter, while a colloid will not so pass. This point is important in showing that a colloid presents a very large surface area, or surface of contact, which is the property on which colloidal treatment of water generally depends when dealing with the prevention of crystalline growth.

The two important properties of colloids which interest us are adsorption and coagulation, the former being a surface action on which the principal application of colloids to feed water depends, as a colloid present throughout a water system will adsorb any and every solid particle which is present, irrespective of its chemical composition. By the process of adsorption a film of such colloidal substance as is introduced into the water will form over any solid particles that are precipitated from the water by heat or concentration, and that film will prevent crystalline growth, as it will be impossible to build up a crystal growth with such a film coating over each scale crystal.

The prospect that colloidal treatment is a universal specific against crystalline growth (crystalline growth being scale formation) is a claim that may sound far-reaching, but it is considered that it can be fully substantiated.

It cannot be too strongly emphasised that in colloidal treatment the action is purely physical, no chemical reactions being anywhere involved, so that it is not necessary to have a complete mineral analysis of the water except for the purpose of estimating the total amount of solids which will have to be dealt with. If chemical examination is needed so that the composition recommended has to be adjusted to react with the scale-forming matter in the water, then such a system is bound to be chemical in principle, because if it were really colloidal it would not require alteration for different types of water.

The property of coagulation is fairly important: it is possible to have a substance in a colloidal state which, either by heating or by the addition of small quantities of chemicals, will be coagulated; the bearing of this on water treatment is that if such coagulation takes place, then, the substance has lost its colloidal properties and become useless from the point of view of adsorbing the scale-forming crystals. Many experiments have been carried out with the object of producing a colloidal solution in a convenient and cheap form; concentration for convenience of transport presents some difficulty, because if a colloid is evaporated the dehydration prevents the substance being brought back into its colloidal state if an attempt is made to re-dissolve it, which fact proves that the term "colloidal" applied to some boiler solutions is a misnomer.

Most minerals are crystalloids, whilst colloids are usually organic substances, and the author's experiments have shown that linseed is a very convenient substance from which to extract starch in the colloidal form; ordinary commercial linseed gives the following analysis:—

Oil	39 per cent.
Albuminoids	23 ,, ,,
Digestible carbohydrates ...	25 ,, ,,
Woody fibre	11 ,, ,,
Ash	8 ,, ,,

If the starch can be extracted from the carbohydrates in a convenient form, leaving behind the other matter which is of no use for the purpose in mind, then a substance is obtained quite rich in the product required (that is, starch). The oil, of course, would be dangerous if introduced into any feed-water system. If, therefore, crushing the linseed can be avoided, at the same time making a water extraction at a temperature above boiling point, the result will be that only the carbohydrates are obtained, and in the very fine state of division necessary for colloidal solution.

Apparatus, similar to what is known in chemistry as an auto-clave, has been used and the system patented: a cast-steel receptacle having inside it a perforated canister contains the linseed, and steam is introduced into the apparatus and infusion of the linseed obtained, the infusion having the colloidal properties necessary for the efficient treatment of feed water. No oil is extracted by means of this equipment, because the pressure at the inlet and the outlet of the apparatus is identical, and therefore no crushing effect is exerted on the seed; only matter which is soluble in water is extracted from the husk of the seed and introduced into the apparatus, which has been so designed that the starch from the linseed is extracted in about twenty-four hours, so that the apparatus only requires attention once every day when the new charge of linseed is introduced.

The amount of linseed required is very small, being approximately one pound of seed to every 2,000 gallons of water, a concentration of approximately one in 60,000; it will be gathered that the amount of colloid introduced is not sufficient to affect in any way the density of the boiler water, and this figure gives some idea of the economy of the whole system. Apart from the positive results which are obtainable by this system, other advantages are the lower cost of upkeep, installation, and also the difference in the space occupied by the equipment, as against a water softener.

In practice both acid attack on the boiler and galvanic action have been arrested.

Where lubricating oil is accidentally introduced into the boiler feed water the colloidal treatment maintains the oil in such a fine state of division that it is not possible for the oil to form the usual deposit and to cause the consequent overheating, a very important point in favour of the colloidal system. A further point is that the system can be used to deal with salt feed: in this respect it is worth mentioning that the French Admiralty has purchased the manufacturing rights for this particular system of colloidal treatment, following on its own tests. This system of treating the water cannot give bare plates, the reason being probably that at the junction of the boiler water and the plates the temperature is sufficient to destroy the colloid, with the result that a thin film of protective scale is always present on the plates. This protective film will never grow to a greater thickness in average installations than about 1/32 inch, as any excess is blistered off. Even this scale is of a soft non-adhering nature which can be brushed or scraped off, and it follows that the system will remove old existing scale. It is believed that the colloid penetrates the cracks of the scale, and for some reason, probably connected with osmotic pressure, the scale is loosened from the plates.

The Electrical Imports of Ceylon.

THE following table shows the value of Ceylon's imports of electrical and allied materials during the past year. The figures have been taken from the recently published official returns. The corresponding statistics for 1926 have been added and notes of decrease or increase are also given:—

	1926. Rupees.	1927. Rupees.	Inc. or dec. Rupees.
Control and switchgear—			
Total, all from U.K. ...	36,000	41,000	+ 5,000
Generators, alternators and dynamos—			
Total	192,600	215,000	+ 23,000
From United Kingdom ...	183,000	197,000	+ 14,000
,, Germany	4,700	6,900	+ 2,200
,, United States ...	2,600	3,200	+ 600
Motors—			
Total	47,000	63,000	+ 16,000
From United Kingdom ...	43,600	57,600	+ 14,000
,, United States ...	4,000	3,000	- 1,000
Transformers and convertors—			
Total	5,000	5,800	+ 800
From United Kingdom ...	3,500	100	- 3,400
,, United States ...	1,500	5,700	+ 4,200
Magnetos, ignition—			
Total, all from U.K. ...	1,400	—	- 1,400

	1926. Rupees.	1927. Rupees.	Inc. or dec. Rupees.
Magnetos, road—			
Total	11,000	4,400	− 6,600
From United Kingdom ...	7,600	4,400	− 2,600
,, Germany	3,000	—	− 3,000
Electric wires and cables (insulated)—			
Total	289,000	296,000	+ 7,000
From United Kingdom ...	273,000	281,000	+ 8,000
,, Germany	1,600	3,600	+ 2,000
,, United States ...	500	500	—
,, Holland	3,600	1,000	− 2,600
Electrical machinery not elsewhere specified—			
Total	354,000	528,000	+174,000
From United Kingdom ...	252,000	276,000	+ 24,000
,, Germany	5,400	16,900	+ 11,500
,, United States ...	48,000	59,000	+ 11,000
,, Italy	9,500	8,600	− 900
Telegraph and telephone instruments and apparatus—			
Total	285,000	401,000	+116,000
From United Kingdom ...	257,000	313,000	+ 56,000
,, United States ...	8,600	14,000	+ 5,400
,, Sweden	3,400	3,700	+ 300
Electric lighting accessories and fittings, including switches—			
Total	354,000	442,000	+ 88,000
From United Kingdom ...	248,000	287,000	+ 39,000
,, Germany	42,000	42,000	—
,, United States ...	23,000	55,000	+ 32,000
,, Holland	29,000	43,000	+ 14,000
Electrical goods and apparatus not elsewhere specified—			
Total	426,000	650,000	+224,000
From United Kingdom ...	332,000	420,000	+ 88,000
,, India	17,000	34,000	+ 17,000
,, France	6,400	8,500	+ 2,100
,, United States ...	48,000	143,000	+ 95,000
,, Germany	12,000	32,500	+ 20,500

The Shanghai Electricity Undertaking.

The Annual Report of the Engineer-in-Chief and Manager.

WE have received from Mr. C. S. Taylor, M.I.E.E., the acting engineer-in-chief and manager of the Shanghai Municipal Electricity Department, a copy of the annual report for the year ended December 31st, 1927, of the engineer-in-chief and manager, Mr. T. H. U. Aldridge, M.I.E.E., on the working of the undertaking. The total sales of electricity for all purposes amounted to 400,343,385 kWh, as compared with 408,245,810, a decrease of 1.93 per cent., which is attributed to the serious and long-continued state of disturbance which took place in the early part of the year. The year's trading resulted in a net profit of Tls. 2,292,554. The estimated net profit for 1928 is Tls. 2,427,300. The gross income for the year amounted to Tls. 11,431,130, and the expenditure was Tls. 7,361,387. The plant capacity of the station is at present 121,000 kW, and the first half of a 40,000-kW extension is being installed (ELECTRICAL REVIEW, May 25th, p. 928). The highest maximum peak load recorded during the year was 90,000 kW, the maximum sustained load for 30 min. was 89,600 kW, and the maximum load delivered to the feeders was 86,025 kW. The load factor for the year was 59.91 per cent., as compared with 61.79 per cent. for the previous year. The overall efficiency of the Riverside station for the year under review was 17.41 per cent.; the figure for the previous year was 17.89 per cent. The lower efficiency is attributed to the same cause as the sales decrease. There were 47,018 consumers being supplied at the end of the year, as compared with 43,378 at the end of 1926. The total capacity of the connections made during 1927 was 14,822 kW; during the previous year the added connections represented 20,484 kW. Eighteen miles of 22,000-V cables were laid during last year, bringing the total mileage of this type of cable in use up to 150. At the end of the year there was 167 miles of 6,600-V cable in service, 22 miles being laid during the year. The capacity of the sub-stations on the system at the end of the year totalled 333,561 kVA. The total h.p. of the motors connected to the mains at the end of the year was 135,613, as against 130,572 for the preceding year. The heating and cooking apparatus connected at December 31st represented a total loading of 26,789 kW, an increase of 7,444 kW on the figure for the previous year. The *personnel* of the undertaking at the end of the period under review consisted of 308 "foreigners" and 3,191 Chinese.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Wireless and Cable Services.

On May 21st, Mr. W. BAKER raised the question of the Imperial wireless and cable services. He said that the Labour Party feared that a very dangerous situation to the nation and Empire was about to arise, if it had not already arisen. They understood that it was proposed to transfer those services to private ownership and control. His great fear was that a recommendation had been agreed to by the Imperial Wireless and Cable Conference, and that that recommendation, based on a provisional decision, had been submitted to the Dominion Governments, and that when they signified their acquiescence the House of Commons would find that the bargain had been concluded and that its hands were absolutely tied. The Prime Minister had stated that he had no previous knowledge of, and no financial responsibility for, the financial merger, which was a definite calculated attempt to force the hands of the Government. The Marconi Company knew how great were the potential profits of the Government beam service. The cable companies were frankly afraid of the success of the "beam," and they entered into the financial merger because they saw no other way of escaping from that competition. The proper course for the cable companies would have been to try to reduce their profits in order that the commercial users might get the best possible service at the lowest possible price. The country was being asked to hand over its Imperial telegraph communication to two groups, one of which had a record for mismanagement and widespread international combinations, and the other of which stated that it could not stand up against Post Office competition, and threatened to scrap its plant and cables.

In the debate which followed, Sir HAMAR GREENWOOD said there was no doubt that the conflict between the beam system, owned by the Post Office, and the Pacific Cable Board, must lead to a certain amount of irritation. Until those systems were transferred to private enterprise there would always be irritation. Mr. AMMON also spoke.

Sir J. GILMOUR, the chairman of the Conference, replied, and dealt in detail with the work which the Conference had already carried out. He said that there had been 30 meetings of the full Conference. They had had to consider not only of how the affairs of this country would be affected, but what repercussions it was likely to have in the Dominions and elsewhere. During the sitting of the Conference the merger between the cable companies and the Marconi Company was announced. This proposed merger, for which the Government had no responsibility, was made subject to satisfactory arrangements being made with the British Government and the Governments of the Dominions and India. The possible reactions of this merger on the problem referred to the Conference had to be examined in great detail, and had necessarily been the subject of conversations between the representatives at the Conference and the companies concerned. The Conference was still in being, and it was quite impossible to say how soon it would conclude its proceedings. The Conference had power only to make recommendations to the Governments concerned, and before any definite action was taken the matter would be brought before the House of Commons.

Broadcasting Developments.

On May 22nd, Sir R. HUTCHISON asked the Postmaster-General whether he could now make any further statement about the possibility of furnishing a high-power broadcasting station in Scotland, preferably in the Midlands, which could supply transmission to the more remote and distant parts of Scotland.

Sir W. MITCHELL-THOMSON said that the British Broadcasting Corporation had a scheme under which the existing broadcasting stations would be replaced by a small number of regional high-power stations. As the first stage in this scheme, a high-power station would be erected near Potters Bar, but as the scheme was still in the experimental stage, he could not give any forecast of its future development in Scotland or elsewhere.

Television.

On May 22nd, Mr. MALONE asked the Postmaster-General whether his department had been kept informed of the progress made in the development of television; and whether, seeing that this invention must necessarily function in conjunction with the national broadcasting services, he proposed to amend the licence and agreement under which the British Broadcasting Corporation now functioned so as to permit that body to employ television.

Sir W. MITCHELL-THOMSON said that the answer to the first part of the question was in the affirmative. With regard to the second part, he was advised that television was still in the experimental stage, and he did not consider that the time had yet come to make arrangements for the provision of a public service.

London Electricity Charges.

On May 16th, Sir HENRY JACKSON asked the Minister of Transport when a settlement might be expected of the details of the sliding scales of prices and dividends as provided for in the third schedule of the London Electricity (No. 1) Act, 1925.

Colonel ASHLEY said that the London County Council, after prolonged negotiations with the companies, was unable to arrive at a complete agreement as to certain items which should be allowed in computing the total amount of costs and charges on which the standard prices for electricity would be based, and the matters in dispute consequently fell to be determined either by arbitration or by the Electricity Commissioners. There were altogether fourteen companies concerned, and the Commissioners had already determined the standard prices in respect of six of them. With regard to the East End group of four companies, to which the question particularly referred, as the London County Council was unable to come to an agreement with three of them, the Commissioners had heard the parties on the points of difference, and certain detailed statements had been supplied by the companies within the last few days which would enable the Commissioners to settle the amounts in dispute and then to determine the standard prices. As to the remaining company (the City of London Company), the Commissioners had been waiting to hear from the City Corporation, which desired to be heard. It was hoped that the standard prices of all four companies would be determined at an early date.

Transmissions from Rugby.

On May 23rd, Sir N. GRATTAN-DOYLE asked what was the nature of the transmissions from the long-distance wireless station at Rugby; for how many hours out of the 24 the station was transmitting; and what was the normal average speed of transmission in words per minute.

Sir W. MITCHELL-THOMSON said that the Rugby telegraph transmitter was employed for about eight hours spread over the whole day, and the telephone transmitter for 14¼ hours a day from 11.30 a.m. to 2 a.m. The telegraph transmissions covered:—British official news bulletins three times a day; wireless Press copyright news messages twice daily; telegrams to ships at sea at scheduled times daily; and Greenwich official time signals twice daily. The speed of transmission was limited to the rate at which reception was possible and was about 20 words a minute. The station was capable of transmitting at a rate of over 80 words a minute. The telephone transmitter sent speech from Great Britain and from several countries on the Continent to the United States of America, Canada and Cuba.

Whitsun Recess.

Parliament rose for the Whitsun Recess on Thursday, May 24th, and will reassemble on Tuesday, June 5th.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A New Welding Dynamo.

High claims for efficiency and simplicity are made by Messrs. ALLOY WELDING PROCESSES, LTD., 14-16, Church Street, Islington, N.1, for their recent development, a new dynamo which they are incorporating in their latest designs of welding equipment, and which will shortly be available. The circular cast-iron casing containing a double-wound oil-cooled transformer, which gave the earlier type its name, has now been eliminated, and in consequence it is claimed that future machines will be cheaper and, what is of more importance, particularly in a portable unit, of considerably less weight. The new dynamo, B.P.200, has been subjected to severe trials, and we understand that those who have tested it praise its performance most highly and pronounce it better than the "transformer-type" machine. The risk of breakdown and the maintenance cost will be considerably reduced by the elimination of such devices as series resistances, reactors, solenoids, and so on, all of which have been omitted in the new generator. Fig. 1 shows a welding set incorporating the new A.W.P. generator and enclosed-type switch and control gear.

Fig. 1.—Electric Welding Set, with New A.W.P. Dynamo.

A Combined Switch and Fuse.

The latest production of the REVO ELECTRIC CO., LTD., Britannia Works, Tividale, Tipton, Staffs., is the "Revo Midget" combined switch and fuse, fig. 2. While this is small and neat it is claimed to be foolproof and of substantial construction. The insulation throughout is of porcelain and mica, and is guaranteed to stand a flash test at 2,000 V and to give an insulation test of 50 megohms. All the current-carrying parts are liberally rated and of heavy section to ensure mechanical strength and rigidity. The rated capacity is 5-10 A at 250 V.

A New Wiring System.

The "Enfield" Type No. 1 wiring system which has recently been introduced by the ENFIELD CABLE WORKS, LTD., Lincoln House, 296-302, High Holborn, W.C.1, is designed primarily to ensure that the consumer shall be provided with an adequately bonded "Safety First" installation. All the cables employed are C.M.A. "Nonazo," single-, twin- and 3-core, metal-sheathed with an alloy of lead and tin which, it is claimed, reduces the tendency of the cable to sag. The cables contain permanent bonding wires of tinned-soft-copper laid under and in direct contact with the metal sheath. These bonding wires are led direct to the terminal in the metal joint box used in the system, the terminal also acting as a support for the box cover. The joint boxes are supplied in two shapes, round and square. The latter, fig. 3, is preferable, particularly in the corners of a room, as cables can be then run straight into the box without bending them, so giving a neater appearance to surface work. Metallic contact with the cables is maintained by the bonding wires being clamped under a central terminal, which also forms a support to the box cover. All straight-through, tee, and branch connections in the joint boxes are made by means of "Midget" one-piece porcelain connectors. These have self-screwing threads which become embedded into the soft copper conductors.

Fig. 2.—"Midget" Combined Switch and Fuse.

Electric Oil Heaters.

A recent introduction of Messrs. ELECTRIC FIRES, LTD., Heatrae Works, Norwich, is a range of electric oil heaters. The "Heatrae" oil heaters are made of heavy steel-plate with welded joints. The oil chamber is fitted with a series of tubes screwed into a tube plate, and into these are passed removable-core "Heatrae" immersion heaters. Control switches are fitted to the heater and protected by an outer steel casing;

two sides of the casing are in one piece which, when bodily removed, gives access to all the switches and electrical connections. The heaters are made in two general types, the "S" type, which is suitable for light oils, and the "M" type, which is specially designed to deal with heavy oils, *i.e.*, oils of high

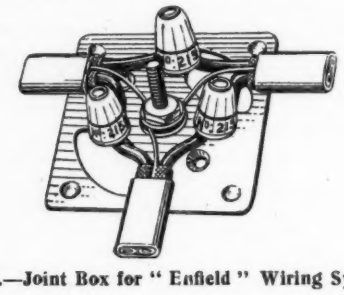


Fig. 3.—Joint Box for "Enfield" Wiring System.

viscosity. The standard "S" type is made to withstand a working pressure of 10 lb. per sq. in., and the "M" type 40 lb. per sq. in., but heaters are also made for working pressures of up to 200 lb. Automatic temperature regulators can be fitted, if desired, and also thermometers, pressure

Fig. 4.—12-kW "Heatrae" Electric Oil Heater.

gauges, relief valves, and so on. The heaters are used for heating quantities of oil in circulation through them, and they are made in standard sizes up to 40 kW, and in very much higher capacities specially to order. They are also made for any supply pressure up to 600 volts, and for d.c., single- and 3-phase a.c. Fig. 4 shows a 12-kW heater.

A New 2-Cycle Oil Engine.

At the recent Royal Dublin Society's Show held in Dublin, Messrs. CLAYTON & SHUTTLEWORTH, LTD., Stamp End Werks, Lincoln, were awarded the highest prize obtainable for some new design features in connection with their recently introduced cold-starting "Clayton-Babcock" oil engine, a 30-h.p. model of which was exhibited. The special feature of the engine is the absence of the usual working air and exhaust valves, which are replaced by cylinder channels of ports. There are only three working parts, the piston, connecting-

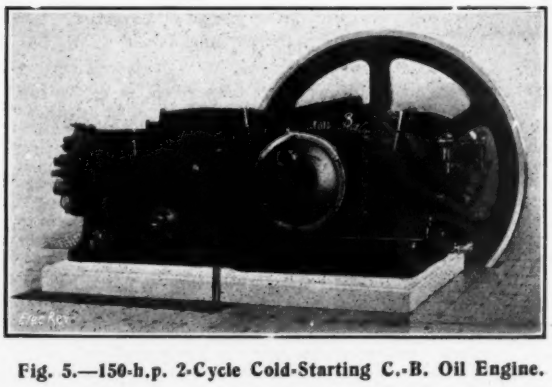


Fig. 5.—150-h.p. 2-Cycle Cold-Starting C.-B. Oil Engine.

rod and crankshaft. It is claimed that the simplicity of the engine brings the maintenance charges down to practically nil. Another interesting point is that the engine employs the two-cycle principle, but retains, it is claimed, the accessibility and sound construction usually associated with the four-cycle engine. It is interesting to learn that the company is installing at the present time a 150-h.p. C.-B. engine at the Martlesham Heath Aerodrome, Suffolk. Fig. 5 shows a 150-h.p., 2-cylinder engine.

A Novel Ceiling Rose.

The accompanying illustration, fig. 6, is of a new ceiling rose produced by the RAMIE UNION, Enschede, Holland, represented in this country by Mr. J. Martin Blair, M.I.E.E.,

Fig. 6.—"Ramie" Non-metal Ceiling Rose.

Audrey House, Ely Place, E.C.1. The main feature of the rose is the complete absence of metal parts, so that it can be mounted, it is claimed, on any sort of ceiling, wall, and so on, without depreciation of its insulation; it is also well recessed. The necessary connections are made by means of "Ramie" one-piece connectors, which enable the apparatus to be fixed and connected up in a few minutes. It will be seen that there are just four "all-porcelain" parts to the ceiling rose, the base, cover, and a couple of connectors.

Correspondence.

Correspondents should forward their communications as early as possible. *No letter can be published unless we have the writer's name and address in our possession.*

Preferential Charges for Electricity.

The original Act governing the supply of electricity expressly stated that "every company or person (in the same area) shall on application be entitled to a supply on the same terms on which any other company or person in such part of the area is entitled under similar circumstances to a corresponding supply." The next clause, *re* "Charges for Electricity," stipulates that no undue preference shall be given. Am I correct in supposing that if any concession is made to one firm or company in a district, other things being equal, all other firms or companies can claim to be supplied at the same rate, or, if they find they have been overcharged, can claim rebate for the years they have been charged at the higher rate? If your readers can say as to this, or quote any cases in point, it would no doubt be of general interest.

Civis.

May 24th, 1928.

[This matter has been the subject of actions at law, which have been reported in our pages. According to J. Shiress Will's "Law Relating to Electric Lighting," unless *all* the circumstances are similar (amount of energy consumed, expense of supplying it and getting payment, uniformity of demand, the time when the energy is required, &c.) agreements may lawfully be made for different terms and at different rates. When different systems of charging are offered, and the consumer may elect on which system he is to be charged, no undue preference is shown, though one consumer may consequently be charged less than others for the same supply.—EDS. ELEC. REV.]

The New Overhead Line Regulations.

Of the concessions offered for low-pressure overhead lines in the new Regulations, the one affording perhaps as much relief as any is the one allowing 19-ft., 17-ft., and 15-ft. ground clearances respectively. This can mean one of three things:

either (1) a longer span than previously, for the same cross-section of conductor, (2) shorter poles for the same span and cross-section, or (3) (and on this I should be glad to receive criticism) the same span, same pole lengths as previously, and an increased sag.

The last condition would result in a decreased stress all round and a corresponding decrease in staying required at angle and terminal poles, and on undertakings where an existing stock of poles is held, would, I think, be the best way of taking advantage of the new Regulations.

To take a concrete example: A four-wire .06 sq. in. line is to be erected along a residential road. In view of service connections, it is impracticable to run longer spans than 180 feet, and the normal sag for this span and cross-section would be about 10 inches at 60 deg. F. Now, if a sag of 20 inches were given to the wires, they would not be below the 17 feet ground clearance, and this would reduce the tension from 1,217 lb. to about 610 lb., or approximately half, with the result that for a safety factor of 2 for conductor and stay, only one 7/8 s.w.g. stay at 45 deg. instead of two would be required at the terminal poles. One 7/8 s.w.g. stay at 45 deg. could replace three 7/8 s.w.g. stays at 30 deg. on a 90-deg. angle pole, and all angles up to about 10 deg. could be negotiated without stays, by simply canting the pole slightly. Thus on a tortuous route, considerable saving could be effected in stays, with a neater job, and considerable economy as a result; the consequent increase in length of copper and additional weight on line poles would only be about 0.1 per cent., and the increase in wind-swing would not be dangerous.

H. M. Price.

Birmingham, *May 22nd*, 1928.

Trade Union Interference.

The article appearing in the current issue of your journal under the heading "Trade Union Interference" is a faithful reproduction of the views held by the inexperienced, brain-picking type of individual holding executive positions in the electricity supply industry to-day, many of whom I happen to know. These individuals obtained their positions in preference to qualified men because they did not require the schedule rate of salary, also due to the application of the particular employer's favourite slogan: "The consumer pays—why worry?" The abject inefficiency of these people is reflected back to our basic industry as evidenced by the piffling outcry for dirt-cheap fuel to avoid the consumer being further exploited. I note with interest that the writer of the article invidiously evades the other side of the question where members of the E.P.E.A. have been victimised by the type of employer and employé I have mentioned.

M. Inst. Fuel.

May 19th, 1928.

Alderman Higham accuses the author of criticising the finding of the No. 3 (North Western) District Joint Board upon a mistaken or incomplete knowledge of the facts. Evidently, therefore, the E.P.E.A. is incapable of presenting an intelligible statement of the case in its own journal.

The facts that Alderman Higham does not appreciate may be stated very briefly:—

(*a*) That the Mains Assistant had not sufficient experience to justify his promotion to a higher grade. (This point was not under consideration by the Board.)

(*b*) That the Ashton Corporation was willing to pay the salary demanded to a suitable man.

(*c*) That, despite Alderman Higham's ruling at the meeting that "the matter must be decided, not in relation to the incompetency of the man in question, but in relation to the duties and responsibilities carried out by him," the finding of the Board was not that a suitable man should be found for the position, but that an unsuitable man should be promoted.

The author must decline to take Alderman Higham's advice to mind his own business; the peculiar findings of District Joint Boards are of more than parochial interest. Further, the E.P.E.A. has a habit of quoting these rulings as a precedent.

The Writer of the Article.

May 28th, 1928.

Wanted—A New Word.

Can anyone suggest a suitable word likely to be universally adopted for that quantity mathematically expressed as:—Volts × amperes × sin ϕ ÷ 1,000? Similar terms are needed for the same quantity multiplied by hours, and for the instrument measuring this quantity, sometimes referred to as a sine meter.

Such terms as one hears are so obviously unsuitable that they are generally employed after a short apologetic hesitation. The names in common use are in consequence varied: for instance, "The er-wattless-kilowatts," or "What-you-might-call-the-sine-units," or "Idle-er-energy."

Reginald O. Kapp.

Westminster, *May 24th*, 1928.

[We refer to this subject in our leading columns to-day.—EDS., ELEC. REV.]

Developments in Current-Transformer Design.

We have noticed in your issue for May 11th, 1928, an article entitled "Developments in Current-Transformer Design," at the end of which reference is made to a method of improving the ratio error by means of fractional-turn correction involving the provision of holes in the core, through which one turn of the secondary winding is wound, the position of the holes being such that this turn embraces either ¼, ½, or ¾, &c., of the whole section of the core.

We would like to point out that this method of fractional-turn correction is standard practice in respect of transformers with single-turn primary windings built by the British Thomson-Houston Co., Ltd., and forms the subject matter of Patent No. 257,360, which was taken out in the names of Mr. J. G. Wellings and the British Thomson-Houston Co., Ltd.

F. H. Clough,

(*Assistant Chief Engineer,*
BRITISH THOMSON-HOUSTON CO., LTD.)

Rugby, *May 25th*, 1928.

Legal.

Radio Dealer Bound Over.

BEFORE the Common Serjeant, Sir H. F. Dickens, K.C., at the Central Criminal Court, on May 22nd, Hudson Orton, described as an agent, surrendered to bail and pleaded "not guilty" to an indictment charging him with the fraudulent conversion of £45.

Counsel for the prosecution said that the defendant was a dealer in wireless sets and electrical goods and some time ago he entered into an arrangement with a Mr. Herbert Richards and Richards's brother, to obtain two wireless sets. The three men visited the premises of the General Electric Co., Ltd., Kingsway, and two sets each priced at £30 were chosen. Orton said that he could get 25 per cent. discount, and Mr. Herbert Richards gave him £45 to purchase the goods. The wireless sets had never been delivered to Mr. Richards nor had his money been returned. When Orton was arrested he told the police that he had lost the money.

The accused was found guilty, but the jury recommended him to mercy, and the judge bound him over in the sum of £100 to come up for judgment if called upon.

Fraudulent Consumption of Electricity.

AT the Derby Police Court on May 25th Arthur O. Panzer was summoned by the Corporation for applying a wire to his meter so as to get electricity for nothing. The defendant stated that he put on the wire the night before an inspector called. The light ran out and he had not a shilling, so he resorted to that method to get light by which to go to bed. He declared that he had no intention of defrauding the Corporation, and thought the current would be registered. The Bench imposed a fine of £1.

Fire Alarms.

At first sight it would appear that there is little connection between automatic telephones and fire-alarm apparatus, but as a matter of fact, in precision of manufacture, principle of operation, and reliability in service, the two are akin, a fact which explains the inclusion of A.T.M. products among the exhibits at the annual Congress of the Professional Fire Brigades' Association at Portsmouth, May 23rd to 25th. As the manufacturer of Beasley-Gamewell fire-alarm equipment, the Automatic Telephone Manufacturing Company's principal exhibit comprised a range of positive non-interfering succession street alarm boxes, which safeguard every contingency, together with sector boxes, which meet the less exacting requirements of small towns, urban areas, &c. Both types are designed for closed-circuit working, the circuits being constantly under current and self-recording in the event of a failure at any point. In addition, the interests of the fire brigade staff are protected by the permanent record giving the exact time, date, and origin of all calls received. (See ELEC. REV., September 2nd, 1927.)

Cat Causes a Short Circuit.

A cat which strayed on to the controls at the Church Lane sub-station, Tottenham, of the North Metropolitan Electric Power Supply Co., in the early morning of May 19th, trod on some "live" wires, caused a short circuit, and was killed. An explosion followed, Edward Carey, the engineer-in-charge, being severely burnt about the face and arms. He succeeded, however, in cutting out the main switches and telephoning to the fire brigade and the main power station for assistance. Engineers were sent to the sub-station and a normal supply was resumed within two hours.

Reviews.

Applied Thermodynamics. By WILLIAM ROBINSON. Pp. x+564; figs. 208. 9¼ in. by 5¾ in. by 1⅝ in. London: Sir Isaac Pitman & Sons, Ltd. Price 18s. net.

This book takes its title from that recently introduced for the examination in heat engines for the B.Sc. degree (Engineering) examination of the University of London. While, however, the title Heat Engines might not be wide enough to include such branches of the subject as the theory of gases, the new title Applied Thermodynamics certainly suggests the application of the principles of thermodynamics to the design of heat engines, a subject which is far more practical than that dealt with in the book under review. We are quarrelling not so much with the book as with the syllabus of the examination, which seems to put a premium on purely theoretical knowledge as against that practical knowledge which not only results in the economical operation of heat engine plant but by pointing out the limitations of existing designs frequently leads to discoveries of far-reaching importance. There is, however, much that we consider of great value in this book over and above the usual theories underlying the steam engine, both reciprocating and rotary, and the internal-combustion engine. Thus, there is a very instructive chapter on the combustion of fuels which covers both external combustion as in the furnaces of boilers and internal combustion as in the cylinders of petrol engines and gas engines, and which includes such subjects as the measurement of calorific value for solid, liquid, and gaseous fuels as well as the theories of combustion, including such phases of the subject as rate of flame propagation, pinking, and detonation. We regret that the author his not been able to include an outline of the theory of the combustion of pulverised coal, as this would have proved of exceptional value to engineers in modern power stations. We like also the chapters on Air Compressors and Mechanical Refrigeration, the former in particular serving as a valuable survey of a subject of great importance to those electrical engineers who may have to deal with Diesel driven generators where compressed air is employed for starting purposes and for fuel injection.

It will be realised, therefore, that while the book, under a different title, covers the subject which has hitherto been known as the "theory of heat engines," it includes, as we have indicated above, various applications of those theories which are of particular interest to the engineer in view of the developments which are taking place in modern heat engine practice. The author suggests that the purpose for which his book has been written is to aid engineering students and engineers studying heat engines and the scientific principles which condition their performance and thermal efficiency. We have already indicated that the scope of the work is that laid down in the syllabus for the examination in Applied Thermodynamics for the B.Sc. degree, and it may be added that it also includes a portion of the work suitable for engineers taking the associate membership examinations of the three principal Institutions. But, in addition, we think that the power station engineer, freed from the fetters which bind him to the syllabus of any particular examination, might study this book in order the better to understand the theories which underlie the design and operation of the machinery in his charge. The use of curves and diagrams forms a feature of the book, the author having found in virtue of his work as a teacher that facts can be more clearly understood when set forth graphically than when merely explained in words and by the use of symbols. But while agreeing with him in this, we regret that he did not extend the principle by including a few more diagrams and sectional drawings of actual engines. Those diagrams—other than curves, &c.—are often rather on the small size, while there is an almost entire absence of half-tones and drawings of engine parts, although these to a certain extent appear to be demanded by the text. On the other hand, we have nothing but praise for the way in which recent experimental work in the development of the theory of heat engines is described and illustrated in this book. While this branch of applied science is being rapidly extended owing to the strides which are taking place in heat engine practice, Mr. Robinson has succeeded in including the most recent theories and investigations within the pages of his book. We congratulate him on the success which has attended his efforts to survey the whole field of applied thermodynamics right from the early work of Carnot and Joule to that of Callendar and Ricardo, and we commend this book not only to students but to all those engineers who are interested in the more theoretical side of their profession.

A.R.

Munro & Jamieson's Pocket Book of Electrical Rules and Tables. Revised under the supervision of (the late) W. R. COOPER and ROLLO APPLEYARD. Pp. viii+765; 311 figs. London: Charles Griffin & Co., Ltd. Price 18s. net.

Those who worked or studied under the late Professor Andrew Jamieson will remember that he constantly described "M. & J." as "the electrical engineer's Bible"; and no one consulted its pages more religiously than himself. The original Pocket Book was indeed an ever-present help in time of trouble to those who had not yet stored in their memories all the formulæ and data required in their daily round of duties, and to many of the more expert, whilst it contributed largely to the solution of the countless problems that cropped up in those days, 40 years ago, when electrical engineering was truly in its infancy. Moreover, the Professor assiduously revised its contents and brought them up to date, issuing new editions at frequent intervals, and invariably execrating the remissness of his partner in its authorship, who, he alleged, gave him no assistance in the task. "M. & J." and Kempe's invaluable "Handbook of Electrical Testing" were the two mainstays of the electrical engineer in the eighties, so far as formulæ and tests were concerned—what a contrast with the wealth of electrical literature at our command to-day!

The death of Prof. Jamieson in 1912 checked the stream of new editions, and for some years none has been issued; we now have to give a cordial welcome to the "New Munro and Jamieson," in the form of the 22nd edition, completely revised, reset, and recast in a more convenient form—*i.e.*, opening like an ordinary book. The Editors, recognising the merits of the old book, have retained some of the familiar original articles, "notwithstanding a certain degree of quaintness," because their substance is based upon long experience, especially in submarine telegraphy (Jamieson's own speciality). But a large amount of new matter has been introduced, much of it dealing with subjects which had not been so much as heard of in the authors' time. For this purpose nearly a score of eminent specialists have collaborated with the Editors and publishers; their names are tabulated before the preface, and sufficiently guarantee the quality of the new sections.

Turning over the earlier pages, we find much to remind us of the old book—interspersed with numerous paragraphs and illustrations dealing with more recent developments, such as the cathode-ray oscillograph, the Abraham voltmeter for pressures up to 200,000 volts, the thermo-galvanometer, and the Appleyard conductometer. Measurements of capacity and inductance are dealt with on modern lines, and electrical methods of temperature measurement are fully explained. Much new matter on magnetic measurements has been inserted, but the classic section by Sir J. A. Ewing has been retained. Most of the section on conductors is, of course, entirely new, including numerous tables and occupying 95 pages; dielectrics are also adequately covered. Submarine cables are allotted 98 pages, the latest developments in construction and equipment being included, and new sections on telephony have been inserted, automatic telephony and valve amplifiers being amongst the new features. Fifty-one pages are devoted to wireless telegraphy and telephony. Then, after a section on electro-metallurgy, there follow sections on the various branches of heavy-current electrical engineering—dynamos, transformers, &c.—occupying 144 pages, mainly new matter. Sections on illumination, and miscellaneous items, including Bottomley's four-figure log tables, with a comprehensive index, complete the volume.

The true merit of a work such as this can only be gauged by use; but so far as we can judge this edition will prove to be a worthy successor to the long line of its forerunners, and would gladden the heart of Andrew Jamieson himself, could he fondly handle it as of old. It is exceptionally well printed, on special paper, and does credit to its publishers. The surviving editor and his collaborators are to be congratulated on their success in that very difficult and laborious task—restoring the youthfulness and usefulness of a technical work that had fallen somewhat out of date, and instilling into it new vigour and vitality.

Pitman's Technical Dictionary in Seven Languages. Compiled by Ernest Slater, M.I.E.E., M.I.Mech.E., in collaboration with leading authorities. In 36 fortnightly parts: Parts 1 and 2. London: Sir Isaac Pitman & Sons, Ltd. Price 2s. 6d. net each part.

Those who have had occasion to translate technical works into foreign languages know, only too well, how frequently expressions are met with which defy interpretation with the aid of the ordinary resources: some are coined by the authors, others have come into use since the existing dictionaries were compiled, and many have no direct or concise equivalents in other tongues. Whether it was desperation at the lack of adequate and comprehensive dictionaries that impelled Mr. Slater to embark upon this colossal undertaking, or whether pure philanthropy was the motive, we do not know: but of one thing we are certain—that he has earned the hearty thanks not only of his fellow-countrymen, but of those engaged in the engineering industries throughout the world. How great a task he took up may be gathered from the fact that the work comprises nearly 2,000,000 words, and embraces English, French, Spanish, Italian, Portuguese, Russian, and German; this is, we believe, the first time that Portuguese has been included in a polyglot technical dictionary. The alphabetical portion of the work will occupy over 2,000 pages; it has been in preparation for 12 years, and incorporates the many new words and phrases that have come into use during the past 20 years, a period of great activity in all branches of technology. No one man, of course, could attempt such a task unaided; the author has been fortunate in securing the help of competent authorities in all parts of the world, including British and foreign scientific and technical institutions, Government departments, manufacturers, commercial organisations, the Press of all countries, and a number of expert collaborators, to all of whom generous acknowledgment

is made in the introductory pages, from which we learn that an enormous amount of technical literature was closely scrutinised and a vast correspondence was carried on.

The bulk of Part 1 is devoted to Sections I to V, which deal respectively with the art of technical translation, peculiarities of diction, adopted (English) words, idiomatic modes of expression in the various languages, and engineering abbreviations. In these Sections, which occupy 62 pages, the Editor has given us a most valuable commentary on languages in general as used for expressing ideas relating to technology, revealing a profound insight into the mental attitudes of different nationalities, and emphasising the necessity of dissociating the meaning of a phrase from its mode of presentation when translating from one language into another. Section II is a mine of information regarding dangerous pitfalls, some of which, if not guarded against, may lead to costly results. Section III, on English words adopted abroad, contains the useful warning that the meaning has often been modified in the process of domestication, and may even have become unrecognisable; for example, our word "raid" has come to mean an "aerial trip" in Spanish and Italian, and the tripper is a "raidman." Similarly common English phrases, dealt with very fully under separate language headings in Section IV, often present serious difficulties to the translator, and the use of initial letters and other methods of abbreviation, of which a lengthy list is given in the next Section, is very liable to lead to ambiguity; for instance, five meanings are given for the letters "s.c.," "s.p." and "s.s." respectively.

Section VI is the technical dictionary itself. This is arranged in eight columns to an opening, the English alphabetical series of words and expressions being repeated to facilitate reference. The great majority of the items are not single words, as in an ordinary dictionary, but compound expressions, or nouns qualified by adjectives; in many cases a catch-word, printed in bold type, is followed by numerous allied expressions—for instance, the word "ammeter" heads a list of 30 items of which it is a component, and "arc" is allotted no less than five pages (2½ openings). We do not, however, propose to take the reader through the dictionary; so far as can be judged from the parts that have already appeared, it will be an invaluable aid to the electrical engineer, as well as to technologists in many other branches of industry, and Mr. Slater, who is the editor of the *Electrical Times* and allied journals published in French and Spanish, has earned their gratitude by the production of this monumental work.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1926.

30,668. "Electrical heating apparatus." American Register Corporation. December 3rd, 1925. (262,460.)

1927.

260. "Sound-reproducing, amplifying, and like devices." F. Clutsam and M. M. D. Clutsam. January 4th, 1927. (289,910.)

347. "Mechanical delayed-action devices particularly applicable to telegraphy." S. E. Appleton, K. L. Wood, and Eastern Telegraph Co., Ltd. January 5th, 1927. (289,911.)

2,741. "Automatic telephone systems." Siemens Bros. & Co., Ltd., D. A. Christian, and H. E. Humphries. January 31st, 1927. (Addition to 265,732.) (289,928.)

3,007. "Systems for the storage and consumption of electric current at one voltage derived from a higher voltage source." W. J. Rickets. February 2nd, 1927. (289,939.)

3,034. "Electric lever switch." E. Wender (L. Mainusch, and J. Hager). February 2nd, 1927. (289,941.)

3,239. "Means for supporting electric conductors." British Thomson-Houston Co., Ltd., and M. C. I. Hunter. February 4th, 1927. (289,957.)

3,269. "Wireless receiving sets." M. Trouton. February 4th, 1927. (289,961.)

3,373. "Method of electro-depositing rubber and the like from latex." W. A. Williams. February 7th, 1927. (289,965.)

3,416. "Voltage regulators." British Thomson-Houston Co., Ltd., F. H. Clough, and H. W. Taylor. February 7th, 1927. (289,966.)

3,617. "Telephone systems." Associated Telephone & Telegraph Co. February 12th, 1926. (265,971.)

3,689. "Electric vacuum or gasfilled tubes." H. Wade (Naamlooze Vennootschap Philips' Gloeilampenfabricken). February 9th, 1927. (289,975.)

5,783. "Automatic or semi-automatic telephone systems." Coventry Automatic Telephones, Ltd., and C. W. Wilman. March 2nd, 1927. (289,992.)

5,821. "Devices for indicating the charging condition of electrical storage batteries." G. H. O'Brien (H. T. Aspinal and E. E. Howell). March 2nd, 1927. (289,993.)

5,862. "Electrical signalling and/or controlling systems." Metropolitan-Vickers Electrical Co., Ltd. March 2nd, 1926. (267,130.)

5,982. "Alternating-current bridge-measuring apparatus." W. I. Place and Metropolitan-Vickers Electrical Co., Ltd. March 3rd, 1927. (Cognate application, 31,894/27.) (289,995.)

6,060. "Electric remote-control and indicating systems." W. E. Beatty (Electrical Research Products, Inc.). March 4th, 1927. (Patent of addition not granted.) (289,996.)

6,174. "Alarm clock electric switch." R. W. Shooter. March 5th, 1927. (289,997.)

6,376. "Elimination of disturbing waves or oscillations in alternating-current electrical circuits." C. Lorenz Akt.-Ges. March 19th, 1926. (267,916.)

6,715. "Wireless transmitting apparatus." A. H. Midgley. March 10th, 1927. (Addition to 280,981.) (289,999.)

6,949. "Brushes and brush holders for dynamo-electric machines." J. Stone and Co., Ltd., and A. E. Honey. March 12th, 1927. (290,002.)

7,634. "Electric motors." R. C. Graseby. March 19th 1927. (290,006.)

7,769. "Electric discharge tubes." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabricken) March 21st, 1927. (290,007.)

8,123. "Loud-speakers and similarly operating acoustic apparatus." C. Menkens. March 24th, 1927. (290,010.)

8,136. "Wireless receiving unit." A. M. H. R. Brown and S. G. Brown, Ltd. March 24th, 1927. (290,011.)

8,201. "Sparking plugs and other fittings in pocketed castings." J. A. Mumford. March 25th, 1927. (290,012.)

10,707. "Motor vehicle headlights and other light-projecting devices." A. Parton. April 21st, 1927. (290,029.)

10,941. "Electrical precipitation of small particles from gases." Lodge-Cottrell, Ltd., and L. Lodge. April 23rd, 1927. (290,030.)

11,239. "Thermionic valve circuits." F. J. Johnston. April 27th, 1927. (290,032.)

11,385. "Electric protective arrangements for alternating-current power circuits." Electrical Improvements, Ltd., and J. R. Beard. April 28th, 1927. (290,033.)

12,814. "Alternating-current induction motors." British Electric Plant Co., Ltd., A. W. Maudling, and H. B. Clarke. May 12th, 1927. (290,043.)

13,836. "Galvanic batteries." E. Wolff. May 23rd, 1927 (290,047.)

16,196. "Piezo-electric devices." Telefunken Ges. fur Drahtlose Telegraphie. June 18th, 1926. (272,954.)

17,957. "Electric arc welding." British Thomson-Houston Co., Ltd. August 2nd, 1926 (275,197.)

18,712. "Electric fuse-boxes." A. Baderna. July 14th, 1926. (274,483.)

18,739. "Suspension insulators." Brown, Boveri et Cie. Akt. Ges. Abteilung Installationen. July 29th. 1926. (275,210.)

19,169. "Electric lighting systems for mines and electric couplings therefor." R. Meyer, Maschinenfabrik Westfalia Akt. Ges., and C. Loos, Dr. E. Oppenheimer and O. Sonnewald (trading as C. Loos & Co.). July 19th, 1927. (290,069.)

19,422. "High-frequency telephony." Telefunken Ges. fur Drahtlose Telegraphie. August 6th, 1926. (275,595.)

19,604. "Electric distant control systems." E. Granat and Compagnie des Forges & Acieries de la Marine et d'Homecourt. September 28th, 1926. (Patent of addition not granted.) (278,323.)

19,815. "Mercury-vapour rectifiers." International General Electric Co., Inc. July 26th, 1926. (274,914.)

21,352. "Manufacture of luminous electric discharge tubes." J. B. J. M. Abadie. August 14th, 1926. (276,018.)

22,392. "Support for electric flashlights or battery lamps." W. C. Embury. August 25th, 1927. (290,084.)

24,881. "Radio-active material." Dr. A. Fischer. September 29th, 1926. (278,347.)

25,632. "Asynchronous dynamo-electric machines" International General Electric Co., Inc. September 30th, 1926. (Addition to 237,911.) (278,366.)

25,863. "Driving of magnetos or other ignition devices in internal-combustion engines." A. J. H. Elverson. September 30th, 1927. (290,007.)

26,617. "Electrically-driven shaker conveyors." T. G. Nyborg and M. F. Higgins October 7th, 1927. (Addition to 273,120.) (290,102.)

27,409. "Electrical rectifiers" Metropolitan-Vickers Electrical Co., Ltd. October 15th, 1926. (279,117.)

28,237. "Means for charging batteries and supplying current to telephone circuits." Siemens & Halske Akt. Ges. October 23rd, 1926 (279,508.)

29,058. "Glass, glazed, or the like insulators." J. E. Pollak (Hermsdorf-Schomburg Isolatoren Ges.). October 31st, 1927 (290,110.)

31,504. "Amplifying arrangements for telephone lines." Siemens & Halske Akt. Ges. November 24th, 1926. (281,299.)

32,407. "Gasfilled electric lamps." General Electric Co., Ltd. December 7th. 1926. (Addition to 248,680.) (232,043.)

34,289. "Electric heating elements." G. Pate and J. R. Laird. December 19th, 1927. (290,134.)

35,480. "Device for fixing bolts to electric insulators." Steatit-Magnesia Akt. Ges. February 17th, 1927. (285,433.)

1928.

185. "Radio-receiving systems." British Thomson-Houston Co., Ltd. January 3rd, 1927. (283,120.)

187. "High-frequency signalling systems." British Thomson-Houston Co., Ltd. January 14th, 1927. (283,578.)

276 "Electrodes for arc welding and process of making the same." British Thomson-Houston Co., Ltd. January 15th, 1927. (283,582.)

2,181. "Protection of cables." Siemens-Schuckertwerke Akt. Ges. January 24th, 1927. (284,217.)

3,599. "Simultaneous charging and discharging of storage batteries." Siemens-Schuckertwerke Akt. Ges. April 5th, 1927. (288,249.)

7,567. "Reproduction of pictures and the like in picture telegraphy." C. Lorenz Akt. Ges. April 5th, 1927. (288,257.)

8,070. "Variable light-producing apparatus, including an electric discharge lamp, particularly intended for sound-recording." British Thomson-Houston Co., Ltd. March 25th, 1927. (287,500.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be lodged within one month from May 23rd:—

Dynic. No. 482,927. Class 8. Apparatus for use as a substitute for electric batteries.—A. D. Jones, trading as Jones & Stewart, 247a, St. Vincent Street, Glasgow.

Deac (lettering and design). No. 487,844. Class 8. Electric accumulators and parts thereof.—A.F.A. Accumulators, Ltd., 120, Tottenham Court Road, W.1.

Maerillium. No. 488,019. Class 13. Cathodes of ordinary metal for thermionic valves.—J. R. Sinclair, 7, Mornington Avenue, Ilford, Essex.

Silent Service Sircator (lettering and design). No. 489,115 Class 18. Electrical installations for use in offices for recording at a distance the names and other matters descriptive of callers desiring interview.—G. J. W. Evans, trading as Geo. Evans & Co., 94, Albany Street, Regent's Park, N.W.1.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERDEEN.—Extension of fish market (£130,000); city engineer.

ALTRINCHAM.—Extension of the County High School for Girls; F. A. Browne, county architect, Newgate Street, Chester.

ATHERSTONE.—Central school; Warwickshire Education Committee.

AYLESBURY.—Extensions to printing works, Hazell, Watson & Viney, Ltd. Extensions to cheese factory, Bicester Road, for the Dominion Dairy Co.

BADDESLEY.—Central school; Warwickshire Education Committee.

BASINGSTOKE.—Staff cottages at Park Prewett hospital (£4,000); Hampshire C.C.

BISHOPSTOKE.—Staff accommodation at sanatorium (£3,000); Hampshire C.C.

BRIGHTON.—Studio, &c., Diocesan Training College, Ditchling Road; College Committee. Stables, &c., at racecourse (£25,000); borough engineer. Classrooms, dormitories, &c., Hollingbury Court, Ditchling Road; O. Morgan.

BRISTOL.—Public baths and washhouses for the T.C.; L. S. McKenzie, city engineer (returnable deposit of £3 3s.).

CLOWNE.—Additional 42 houses for the R.D.C.; J. Haslam, architect, Chesterfield.

COVENTRY.—Rehousing scheme (38), Gulson Road and Harnall Lane; E. H. Ford, city engineer.

CROYDON.—Forty houses, Grangecliffe Gardens; G. Poulton and Son, 11, Westbrook Road. Development, Spring Park Estate; Spring Park Estates, Ltd. Dance hall, London Road; Mrs. A. Clark, "Sherrington," London Road. Alterations and additions, Mayday Road Hospital, for the T.C.; Henry Berney, architect, 33-35, High Street(returnable deposit of £3 3s.).

DERBY.—Surgical wing, operating theatre, &c. (£23,200), Queen Mary nursing home; Naylor, Sale & Woore, architects; Walkerdine, Ltd., builders.

DORKING.—Post office, telephone exchange, engineer's department, depot and garage; H.M. Office of Works, King Charles Street, London, S.W.

EASINGTON COLLIERY (Co. DURHAM).—Church of the Ascension (£4,000); incumbent.

EASTBOURNE.—Turkish baths (£12,000), for the T.C.; borough surveyor.

EAST WITTERING (COLCHESTER).—Extensions, Bracklesham Bay Hotel, for Brig.-General De la Warr; H. A. R. Barry, architect, London.

ECCLES.—Housing scheme (64), Edison Road Estate (deposit £2 2s.); T. Elce, borough engineer.

GRAVESEND.—New Gordon school for the borough E.C.; Education architect, 5, Woodville Terrace (returnable deposit of £3 3s.).

GRIMSBY.—Tuberculosis pavilions, Scartho; borough engineer.

GUILDFORD.—Alterations to headquarters of the Surrey Anti-Aircraft Searchlight Company, R.E.; Jarvis and Richards, Architects, 60, Tufton Street, Westminster, S.W.

HAMILTON.—Reconstruction of premises for the Central Co-operative Society, Ltd.; Gavin Paterson, architect, Cadzow Street.

HECKMONDWIKE.—Secondary school extensions for West Riding E.C. (£14,115); education architect, Wakefield.

HIGH WYCOMBE.—Furniture factory, Abercrombie Avenue, for J. C. Lane (£18,000). School (£6,498), for the borough E.C.; A. C. Dean, builder. Factory, Eaton Avenue, for A. & F. Howland. Extensions to paper mills, for the National Paper & Pulp Co. Factory extensions for T. Glenister, Ltd., F. Parker & Sons, Temple End, and G. Pixton & Co., Queen's Road.

HUDDERSFIELD.—Housing scheme (100), for the T.C.; borough architect. Central baths and sun-ray department; borough engineer, Town Hall.

IPSTONES (STAFFS.).—Memorial Hall; L. McGowan-Twemlow, architect, Cheadle, Staffs. (returnable deposit of £2 2s.).

IRISH FREE STATE (NENAGH, Co. TIPPERARY).—Technical school for the Irish Department of Agriculture and Technical Instruction.

JOHNSTOWN (WREXHAM).—New St. Mary's church (£4,500); E. Glyn Woolley, architect, Neville Crescent, Acton; W. E. Samuel, builder.

KENILWORTH.—Central school; Warwickshire Education Committee.

LANARK.—Police station (£10,000), for Lanarkshire C.C.; clerk.

LEAMINGTON.—School, Temple Balsall, for Warwickshire E.C.; director of education, Warwick. Houses (24), for the U.D.C.; F. G. Bursill, builder, Coventry.

LEICESTER.—Extensions, Wholesale Market, Halford Street; Corporation Markets Committee. Church, Park Estate; Diocesan Extension Board.

LONDON (POPLAR, E.).—Renovations, Poplar Town Hall and Bromley Public Hall (£1,860); borough engineer. Sawmills, 304, St. Leonards Road; J. Hipkin.

(CAMDEN TOWN, N.W.).—Alterations, 193-209, High Street; M. K. Matthews, architect.

(HENDON, N.W.).—Twenty-five shops and commercial buildings, Deansbrook Road; L. Harris.

(ST. PANCRAS, N.W.).—Rebuilding St. Benet's and All Saints Church, Lupton Street; churchwardens. Additions, Hampstead Road and Mornington Crescent; Carreras, Ltd.

(BERMONDSEY, S.E.).—Alterations, Albion Works, Clack Street; G. Green, Ltd., for Kirby Refineries, Ltd.

(BATTERSEA, S.W.).—Block of tenements, Britannia Place (£3,578); borough engineer. Highways depot, Lavender Hill (£7,000); borough engineer.

(WESTMINSTER, S.W.).—Building developments, Grosvenor Estate; Holland & Hannen & Cubitts, Ltd. Buildings site abutting on Regent Street, Piccadilly Circus, and Air Street; J. J. Joass.

(EALING, W.).—Alterations, administrative block and wards, maternity home; E. Willis, chief engineer, Town Hall, Chiswick. 58 houses, Boston Road, for A. J. Taylor; H. A. Steel, architect, 289, Northfield Avenue, W.5.

(BLOOMSBURY, W.C.).—Buildings for British Medical Association, Upper Woburn Place and Tavistock Square; B.M.A. Committee.

LONGTON (STAFFS.).—Alterations, Alhambra Picture House; licensee.

LYE AND WOLLESCOTE.—Housing scheme (46), for the U.D.C.; H. E. Folkes, architect (returnable deposit of £3 3s.).

NEWBURY (BERKS.).—Grammar school extensions (£6,500), for the governors; clerk.

NEWQUAY (CORNWALL).—Masonic Hall (£6,000); F. C. West, builder, Golf Terrace.

NORTHAMPTON.—Electrically-driven steam laundry, Infectious Diseases Hospital, for the T.C.; Alfred Fidler, borough engineer (returnable deposit of £5).

OLDBURY.—Hotel (£14,000), for Mitchells & Butlers, Ltd., brewers, Birmingham.

PENRITH.—Extensions, Burrowgate; Penrith Co-op. Society. Masonic Temple, Tow Hall Garden site; A. Grisethwaite.

PETERBOROUGH.—Arcade of 27 shops; Alan Ruddle, architect, 2, Long Causeway.

PORTSLADE-BY-SEA.—Houses (36), for the U.D.C.; W. H. Green & Sons, builders.

PRESTWICH.—Cinema, Albert Avenue; Astoria Cinema Co., Ltd.

QUEENBOROUGH (KENT). — Glass works equipment (£40,000), for Sheet Glass, Ltd.; P. J. Mitchell, managing director, Westminster.

READING.—School (£13,225), for the Borough E.C.; director of education.

RICHMOND (SURREY).—Shops and flats, Hill Rise, for Alderman Mears.

SOWERBY BRIDGE (YORKS.).—Branch store premises at Fore Lane (Beech Wood Estate); applications to Committee, Sowerby Bridge Industrial Society, Ltd., West Street, Sowerby Bridge (deposit £1 1s.); architects: Architect's Dept. C.W.S., 1, Balloon Street, Manchester.

SWANSEA.—Warehouse, Northampton Lane; G. F. Lovell and Co. Pumping station (Llansamlet (£30,000); South Wales Contractors, Ltd. Elementary school, Baptist Well; Education Committee.

THORNE.—Grammar school (£28,500); West Riding Education Committee.

TIPTON. Manual and domestic centres, Ocker Hill and Park Lane, for the E.C.; Scott & Clark, architects, Regent Chambers, Wednesbury (returnable deposit of £3 3s.).

WAKEFIELD.—Registry for Deeds (£70,500); West Riding county architect.

WHITSTABLE.—Pavilion, &c. (£20,388), with lighting and heating, for the Tankerton Grand Pavilion, Ltd.; J. P. Wild, secretary, 3, Cliff Terrace; J. B. Barton & Co., builders, Strangford Road.

WREXHAM.—Technical school extensions (£16,000), for Denbighshire E.C.; J. C. Davies, director of education.